Environmental Impact Assessment
Stone-Consolidated Inc.
Ash Disposal Facility
Bathurst, N.B.

NOLAN, DAVIS & ASSOCIATES

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Report

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Stone-Consolidated Inc.
Ash Disposal Facility
Bathurst, N.B.

Prepared for:

Stone-Consolidated Inc.

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1.0 INTRODUCTION

1.1 GENERAL

The Stone-Consolidated Inc. (Stone) mill in Bathurst, N.B. currently produces approximately 30 m^3 of biomass ash (ash) daily as a result of burning hog fuel (wood debris and bark) in the mill's boilers. The ash has traditionally been disposed on Stone property to the immediate south of the existing mill. The present ash disposal site is near capacity and continued operation will require additional land which is not available at the present site.

In early 1990, Stone retained Roy Consultants Inc. (Roy) to locate and design a new ash disposal site plus prepare closure plans for the existing ash disposal site. The new site identified by the consultants is located on Stone property to the immediate south of the existing disposal area and bounded by King Avenue to the west and the Nepisiguit River to the east (See Figure 1-1).

Stone, as the proponent, registered the project under New Brunswick Regulation 87-83 of the Clean Environment Act. On November 19, 1990 the Minister of the Environment determined that an EIA study was required to assess the nature and significance of the project's potential impacts. This report, prepared by Nolan, Davis and Associates (N.B.) Limited (Nolan Davis) on behalf of Stone, presents the results of that assessment.

1.2 PROJECT RATIONALE

There are two specific components of the proposed Stone project, namely, the development of a new ash disposal site and the closure of the existing ash disposal site. Following is the rationale for each component.

Stone currently produces up to 70% of the energy requirement for the Bathurst mill through the burning of hog fuel in the mill's boilers. The burning of the hog fuel, which is a renewable resource, displaces the equivalent of approximately 162 million litres of Bunker "C" oil annually. However, a by product of the combustion process is ash which must be disposed of in an environmentally acceptable manner. The ash currently being generated is placed along the western

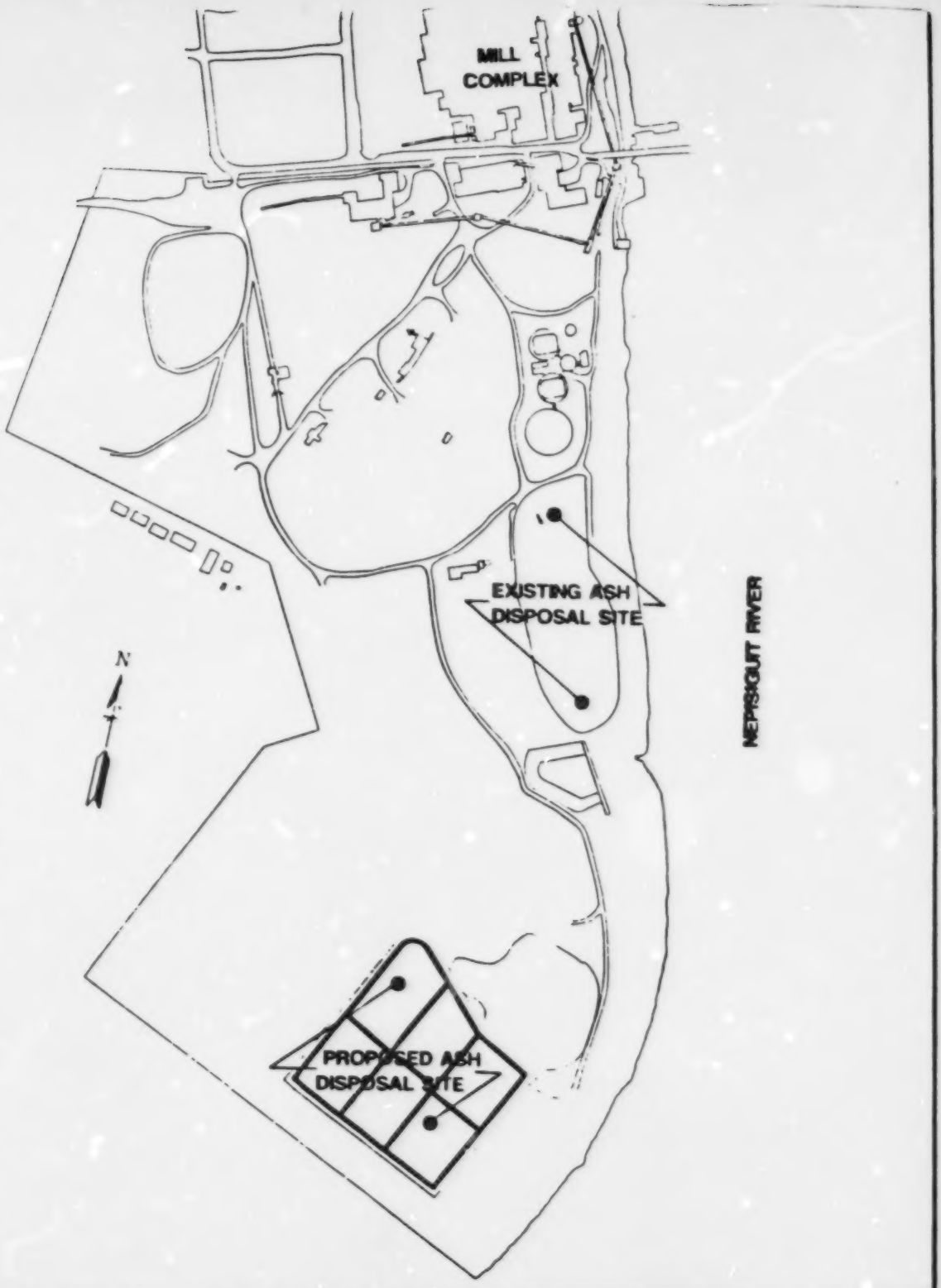

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FIGURE 1-1

EXISTING AND PROPOSED
ASH DISPOSAL SITES
LOCATION PLAN

slope of the existing ash disposal pile. Since the life of the present site is limited, an alternate new disposal site is required. The disposal method best suited for the current Stone operations is in an engineered landfill.

The existing ash disposal site is located to the immediate south of the mill adjacent to the Nepisiguit River. The eastern slope of the disposal pile, which slopes steeply upward 10 to 15 metres above the crest to the riverbank is considered a potentially unstable slope. To minimize the risk of slope failure, which would result in a slide into the river, the slope must be reduced to a more stable configuration. Furthermore, by providing an impermeable cap over the entire stabilized pile, the present undesirable environmental impacts of the site can be mitigated.

1.3 PROJECT ALTERNATIVES

1.3.1 Null Alternatives

The Stone mill currently produces 30 m^3 of ash daily. Without an environmentally acceptable method of disposal for this waste, Stone will have to cease the combustion of hog fuel and use imported oil as an energy source.

The risk of not stabilizing the slopes of the existing ash disposal pile are unacceptable. In addition public concern dictates that a permanent solution be provided to prevent dusting from the pile.

1.3.2 Alternative Sites

The initial selection of potential sites for disposal was based on Stone's criteria to have a site that was already developed adn could accept the generated ash or to devlop a new site on land currently owned by Stone. A further criteria for the new site was acessibility. Constraint mapping was not carried out as part of the site selection process.

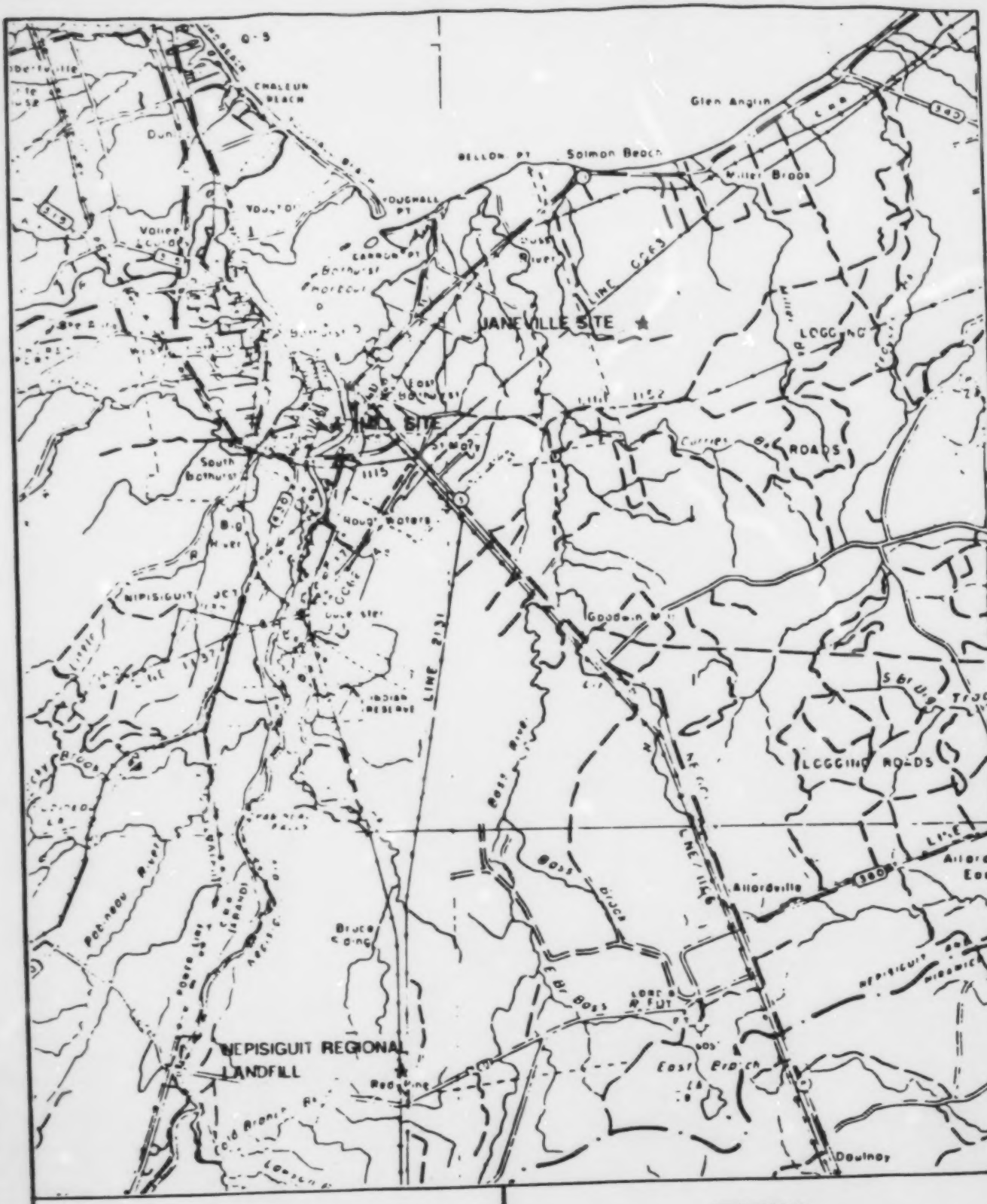

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FIGURE 1-2

ASH DISPOSAL SITE

ALTERNATE SITES EVALUATED

The following three sites were evaluated for a new ash disposal facility:

(1) Nepisiguit Regional Landfill

(2) Janeville Site

(3) Mill Site

The appropriate location of each site relative to the Stone mill complex is shown on Figure 1-2. Following is a summary of the key factors considered in the site selection process.

Nepisiguit Regional Landfill

The Nepisiguit Regional Landfill, located in Red Pine approximately 33 km south of Bathurst, is an engineered landfill site for Municipal Solid Waste (MSW). However, Stone has been refused permission to use the facility for the disposal of ash on the premise that Stone's usage would significantly reduce the life of the current site. Furthermore the landfill is not licensed to handle biomass ash.

Janeville Site

The proposed site is located in Janeville on Highway 11 approximately 13.8 km from the mill. The site, which meets the general New Brunswick Department of the Environment (NBDOE) criteria for siting of a MSW landfill, is currently a gravel pit owned by Stone. Available geologic and hydrogeologic information of the area, coupled with site observations, suggest that site development will require an engineered liner and leachate collection system. Furthermore without a natural impermeable soil cover there is a potential risk to the groundwater quality should there be a failure of the liner. The remoteness of the site makes it desirable from a public perspective. On the other hand, this feature of the site is a major drawback in that any ash would have to be transported over public roads with increased potential for dusting and spillage. It is also more difficult to monitor the operations of a remote site particularly in winter.

Mill Site

The proposed mill site is located to the immediate south of the existing lime sludge pile. The site, which is presently undeveloped land, has very favourable hydrogeologic conditions (Section 3.4) which enhance the site's suitability for use as a ash disposal site. Furthermore, because of its close proximity to the mill, trucks transporting ash will not have to travel on public roads. The location will allow for close monitoring of ash disposal operations.

The Mill Site does not meet the MSW siting criteria for distance from a property line and major streams as well as total area requirement. However, the site meets most of the NBDOE criteria for the siting of MSW landfill (Section 3.9.2).

1.3.3 Alternative Technology

While there will always remain the requirement for an ash disposal site, Stone is currently investigating alternative uses of biomass ash. Two potential users of the ash already investigated are the peat industry, where the ash can be mixed with the peat to produce a compost, and the asphaltic concrete industry, where the ash may be used as a fine aggregate. Although studies to date have shown potential, additional work is required to determine the practicality of these approaches.

The biomass ash has a significant lime content and is a source of potassium, phosphorous, magnesium and other trace elements for plant growth. In other jurisdictions, such as the State of Maine, land application of ash to both farmlands and woodlands has been demonstrated to enhance plant growth. Currently the technology of land application of biomass ash has not been demonstrated in the Province of New Brunswick, although considerable interest has been shown to date by several major New Brunswick forestry based companies as well as several NBDOE personnel. Environment Canada also supports attempts to find environmentally acceptable alternative uses for the ash.

Stone will carry out additional studies to evaluate the potential alternative uses for its biomass ash. Any alternative use of ash must first receive prior approval from NBDOE.

1.4 EIA PROCESS

The Stone proposal to construct and operate a disposal facility for ash plus abandon and close an existing ash disposal facility within the City of Bathurst was registered with the Minister of Environment (Minister) on June 19, 1990, as required under Environmental Impact Assessment Regulation - Clean Environment Act (New Brunswick Regulation 87-83). On November, 19, 1990, the Minister advised Stone that an Environmental Impact Assessment (EIA) will be required.

The Minister of the Environment established a Review Committee which developed Draft Guidelines for the EIA study. The Draft Guidelines were issued for public review on January 13, 1991 and following a 30 day public review period, were revised and issued as final Guidelines on March 13, 1991 (Appendix I). Prior to proceeding with the EIA Study , Stone developed Terms of Reference for the EIA study which were submitted to the Minister on March 17, 1991. An addendum to the Terms of Reference, addressing the specific aspects of the existing disposal site closure, was submitted to the Minister on May 6, 1991.

The Review Committee will evaluate this draft EIA study report to determine whether or not the document has satisfied the Guidelines. If this draft EIA study report is found to be satisfactory by the Review Committee, the Minister will accept the final EIA study report pursuant to Section 11 (4) of the Environmental Impact Assessment Regulation - Clean Environment Act (New Brunswick Regulation 87-83). Stone will then provide to the Minister 30 copies of the final EIA study report in both official languages. A summary of the final EIA study report will be prepared on behalf of the Minister of Environment. The Review Committee will also prepare a General Review Statement summarizing its comments on the document.

Within 30 days of receiving the final EIA study report, the Minister will release the combined documentation for public review and comment. At the same time, a schedule for public meetings to discuss the EIA information will be announced by the Minister. A minimum of 30 days following the release of the EIA information will be provided for public review, before any meeting is scheduled. The public will also be invited to submit written briefs.

Following public meetings, an additional period of 15 days is set aside for members of the public to submit further written comments regarding the proposal. At the end of this period, a summary of public participation will be prepared, and copies will be sent to every person who participated actively in the public discussion. At the same time, the full package of EIA study information, including the public participation summary, will then be forwarded to the Minister for final consideration.

Subsequent to this date, the Minister will submit a report and a recommendation concerning the proposal to the Lieutenant-Governor in council. It is the responsibility of the Lieutenant-Governor in Council to consider the report as well as the recommendation of the Minister, and issue or deny any approval for the proposed project. If approval is given, terms and conditions may be stipulated, to which Stone must adhere in implementing the project.

EIA approval does not exempt Stone from other applicable statutory requirements, such as the provisions of the Clean Environment Act, or any other relevant legislation which applies to the project.

1.5 STUDY METHODOLOGY

The principal objective of the EIA study is to predict the potential impacts which can be expected should the project proceed and identify any means of mitigating these impacts. The scope of work for the EIA has included an analysis and/or description of the following:

- Project rationale and project alternatives
- Project description detailing how Stone proposes to undertake the design, construction and operation of the proposed new facility plus closure of the present site
- Valued Environmental Components and Study Boundaries
- Potential impacts of the project both biophysical and socioeconomic
- Mitigative measures proposed
- Environmental monitoring requirements

The EIA Study has been structured around a comprehensive public consultation program designed to achieve maximum constructive public involvement throughout the process.

The conceptual framework for EIA recommended by Beanlands and Duinker (1983) is based on the perception that, to achieve its sociopolitical goals, the EIA process should be guided by the values and concerns of the public that might be affected by the project. Impacts that are perceived to be socially important must be identified early in the assessment process so that research efforts can be focused on those environmental components and potential interactions of greatest social and economic importance. As well, the advice of the scientific community should be sought to identify problems or interactions that are potentially serious, but of which the general public may not be aware. Together these inputs comprise part of an ecological and socioeconomic issue identification process (scoping) that is required for the identification of Valued Environmental Components. In this EIA study report, Valued Socioeconomic Components and Valued Ecosystem Components are referred to collectively as Valued Environmental Components.

The philosophy of approach for preparation of this environmental impact assessment has been to use available data to provide a level of assessment that is judged to be acceptable. This approach has been employed for most aspects of the study. However, for particularly sensitive elements or Valued Environmental Components (VEC) such as groundwater quality, additional investigations were carried out to provide the information required for impact assessment.

1.6 STUDY ORGANIZATION

The EIA study report is composed of eight sections of which this Introduction is the first. The project rationale and alternatives to the project are also presented in this chapter.

Section 2.0, Project Description, describes both the existing site closure and new ash disposal site development proposals.

Section 3.0 Existing Environment, defines the Valued Environment Components to be considered in the study and then provides a comprehensive description of the existing biophysical and socioeconomic environment in the context of the defined Valued Environmental Components. A discussion of Study Boundaries is also provided.

Section 4.0, Impact Assessment and Mitigation, assess the biophysical and socio-economic components in order to delineate impacts, assess their significance, determine appropriate mitigation techniques, and design the appropriate monitoring programs.

Section 5.0, Monitoring and Compensation, outlines an environmental effects monitoring program for the environmental components for which minor or greater impacts are predicted to occur.

Section 6.0, Public Consultation, outlines the extent to which the public has been involved.

Section 7.0, Conclusions, highlights the major findings of the study.

2.0 PROJECT DESCRIPTION

2.1 SITE DESCRIPTION

The Stone - Consolidated Inc. mill is situated on the west bank of the Nepisiguit River in Bathurst, New Brunswick. The property is divided by Bridge Street such that most of the mill buildings and the employee parking lie to the north. The remaining mill buildings which include the Bathurst Corrugating Medium (BCM) plant and the Woodroom lie adjacent to Bridge Street to the south. The hog fuel conveyors span from the Woodroom to the south of the BCM plant to the hog fuel stockpile and then north along the river's edge under the Nepisiguit River bridge to the boiler room. The chip storage area lies south of the hog fuel stockpile and conveyor system to the west of the newly constructed waste water treatment plant which are situated adjacent to the river's edge.

At present, most solid wastes generated by the mill are disposed of on an approximately 17 ha site lying to the south of the chip storage area and digester tanks. The disposal site is irregularly shaped as shown on Figure 2-1. The northern half of the disposal site can be subdivided as follows:

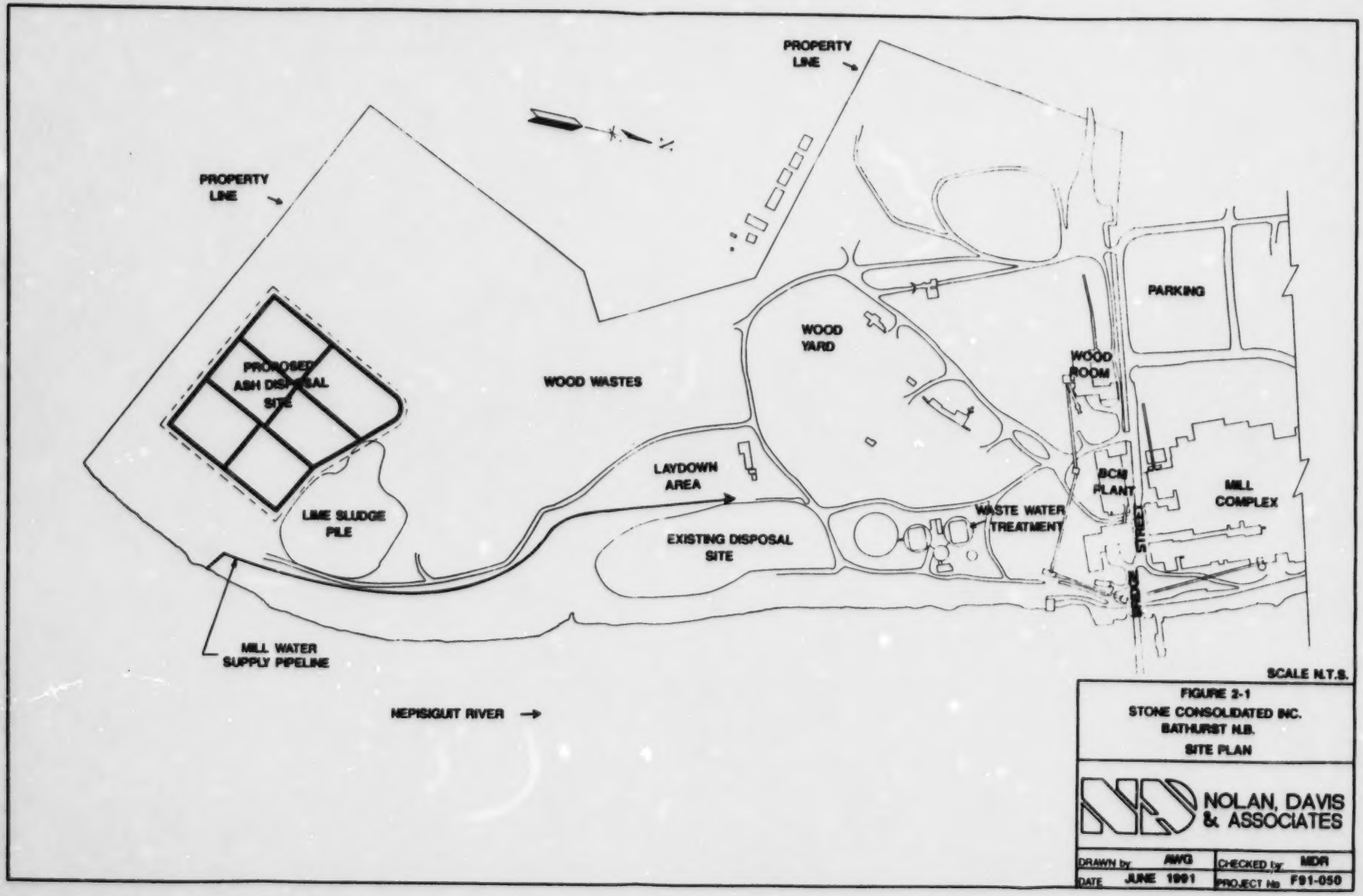
(i) The western third consists of rock chute material (woodroom dropout) overlying stockpiled hog fuel which is separated from a scrap metal lay down area to the east by a north/south access road.

(ii) The lay down area occupies the middle third of this section of the site in conjunction with a north/south drainage channel and a parallel water supply pipeline.

(iii) Between the water pipeline and the river bank is the present disposal area for the biomass ash.

The southern half of the disposal site can be subdivided as follows:

(i) The continuation of the hog fuel pile along the west side of the access road.


PROPERTY LINE
PROPERTY LINE
PROPOSED ASH DISPOSAL SITE
WOOD WASTES
WOOD YARD
PARKING
WOOD ROOM
LAYDOWN AREA
BCM PLANT
MILL COMPLEX
LIME SLUDGE PILE
WASTE WATER TREATMENT
EXISTING DISPOSAL SITE
MILL STREET
MILL WATER SUPPLY PIPELINE
NEPISIGUIT RIVER
SCALE N.T.S.
FIGURE 2-1
STONE CONSOLIDATED INC.
BATHURST N.B.
SITE PLAN
NOLAN, DAVIS & ASSOCIATES
DRAWN by AWG
CHECKED by MDR
DATE JUNE 1991
PROJECT No F91-050

(ii) A lime sludge pile which occupies the southern extremity of the site.

(iii) The unused tree covered area between the road and the river.

The present disposal site is bound on the east by the Nepisiguit River where a 15-18 m high river bank slopes steeply upward from the river at the ground's natural angle of repose and is covered with trees, grass and other vegetation. The shore line is generally straight or smoothly curving except for an indentation at the drainage channel outlet located south of the ash pile. The existing disposal pile has been placed directly adjacent to the crest of the river bank and provides further relief of 12-15 m to the natural ground surface. The lime sludge pile at the southern extremity of the site has a height of 15-21 m above the natural ground while the hog fuel and rock chute storage piles vary from about 3 to 9 m in height.

The proposed ash disposal site is located adjacent to the Nepisiguit River, bounding on the present Stone southern property line to the south-west of the lime sludge pile. The new site is approximately 15 ha in area. When developed, the new disposal pile will occupy approximately 4.7 ha of this site. Presently, the new site is dominated by a broad plateau with an elevation of approximately 30 m in the centre of the site. The ground surface slopes downward from the central platform towards the Nepisiguit River at an 8-10% gradient.

2.2 CLOSURE OF THE EXISTING ASH DISPOSAL SITE

2.2.1 Waste Characterization

The present disposal site covers a 4 ha area with a height above original ground ranging from 12 to 15 m. The estimated total volume of wastes in the pile is in the order of 150,000 m^3.

Solid wastes from the mill have been placed at the site for the last 40-50 years. However, detailed records of the type and quantity of wastes placed do not exist. The following summarizes the current knowledge of the disposal site characteristics based on discussions with Stone personnel plus a review of available information:

(i) The pile is built on a base of lime sludge. The thickness of the lime sludge, as determined in the six boreholes put down through the pile, ranged up to 10 m. The lime sludge was noted to be interbedded with bark and other organics. An aerial photograph taken in 1944-45 indicated that a lime sludge pile existed beneath the northern sections of the present disposal site. Line sludge is no longer being generated by the Mill.

(ii) Biomass ash has been placed in the pile since 1986 when the present mill boilers were brought on line. The ash was placed on the top and along the western side of the pile. The ash was noted to be up to 5 m thick in areas on the top of the pile. It is estimated that over 50 000 m^3 of ash has been placed at the present site to date.

(iii) Construction debris such as broken concrete, timbers, steel, etc. has been placed in the pile throughout the years. Waste bark and overburden excavated from the area of the digester tanks was placed at the north end of the present pile.

(iv) Contour mapping from 1969 aerial photography indicates that south of the mill, ground surface contours ranged from 15 to 32 m. The ground surface at the time of photography was gently rolling with higher ground to the south and east. The maximum height of the disposal site, based on the 1969 mapping, was about elevation 28 m. In contrast, the most recent mapping (June 1988) indicates the boiler ash stockpile as covering a much greater area than in 1969 and having a maximum height of about elevation 33 m.

During the recent construction to stabilize the eastern slope, in excess of 25% of the waste material in the pile was moved from the east to the west side of the pile. The materials encountered during this excavation were principally ash, lime sludge, bark and wood wastes, construction debris, and sand and gravel. During this extensive excavation there was no evidence of wastes other than those noted.

2.2.2 Slope Stabilization

Closure of the existing ash pile will involve increasing slope stability and minimizing rain water infiltration through placement of a vegetated soil cover.

The eastern slope of the existing ash pile prior to recent construction sloped upward from the crest of the river bank at an approximate 1 horizontal (H) to 1 vertical (V) inclination. Considering the heterogeneous nature of the fill in the pile and the method of placement, this steep slope was considered to be unstable, with high potential for slope failure into the adjacent Nepisiguit River. Furthermore, the 1H:1V slope is too steep to allow access of machinery. For long term stability it was recommended that the existing eastern slope be flattened to 3H : 1V with the excavated material placed along the western slope of the pile. The final recommended slope configuration for the remainder of the pile was also 3H : 1V. The eastern slope stabilization will also involve a 6 m wide road along the crest of the original river bank. A typical cross section of both the existing slope and final stabilize slope is shown on Figure 2-2.

The volume of material to be excavated to flatten the slope along the Nepisiguit River was estimated to be about 50,000 m^3. With NBDOE permission, this material has been excavated back to a more stable slope configuration.

2.2.3 Final Cover

The closure of the existing disposal site will require the placement of an impermeable cap over the entire stabilized slope as well as on top of the pile. The purpose of the cap will be to reduce the amount of water percolating through the pile. The NBDOE liner requirement for infiltration control is 500 mm of clayey material having a maximum permeability of 1×10^{-7} cm/sec or equivalent. The clay capping layer is to be placed atop a minimum 150 mm grading layer. A 500 mm thick layer of granular cover material is required over the clay cap for frost protection. A layer of topsoil is required over the granular cover to permit the growth of vegetation. Details of the final slope cover are shown on Figure 2-3.

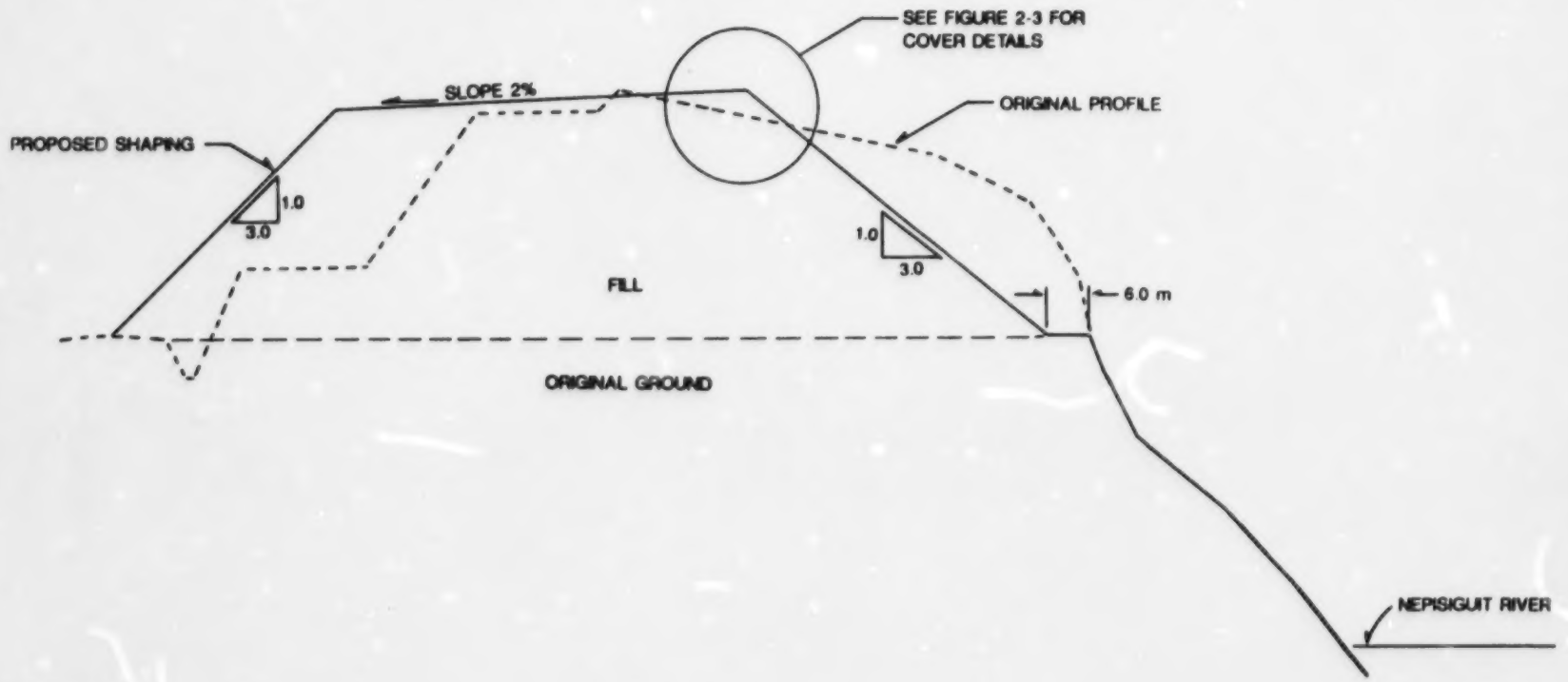


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FIGURE 2-2

CLOSURE OF EXISTING ASH DISPOSAL SITE

TYPICAL CROSS SECTION

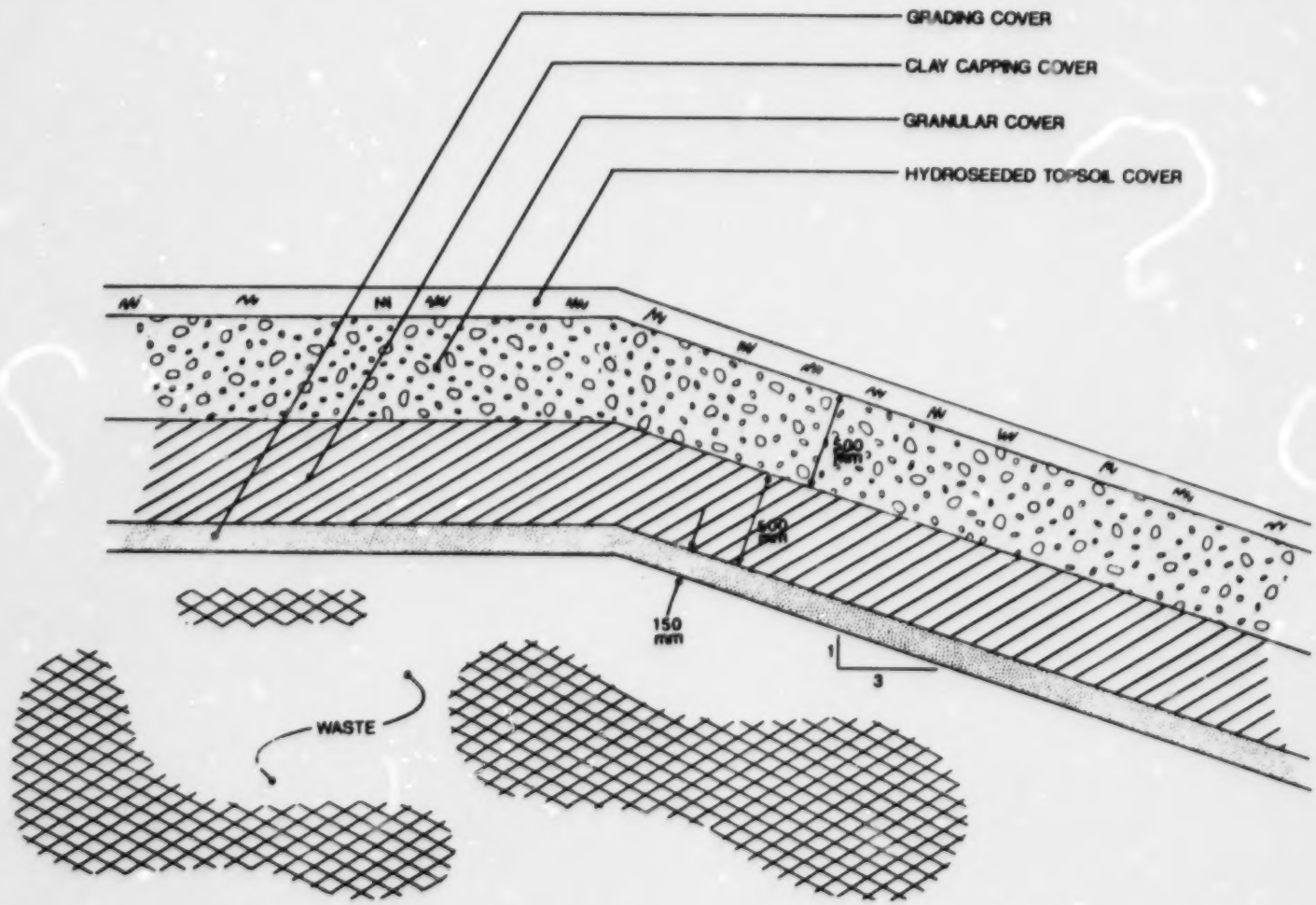

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FIGURE 2-3

CLOSURE OF EXISTING ASH DISPOSAL SITE

FINAL SLOPE COVER DESIGN

The surface of the flattened slopes will be hydroseeded with a self maintaining vegetative cover.

On May 16, 1991, approval was given by NBDOE to place this cover along the eastern slope and on top of the pile, principally for dust control. The cover over the remainder of the disposal site will be placed after approval of the EIA.

2.3 NEW ASH DISPOSAL SITE DESIGN

2.3.1 Waste Characterization

The new disposal site will be dedicated for the disposal of one type of solid waste only; biomass ash. The ash, unlike MSW, does not attract birds or rodents or cause litter problems. Due to a change in process, lime sludge, a major waste at the existing disposal site, is not being produced while bark and other wood wastes are being used as hog fuel. Any construction debris generated at Stone will be disposed of at the Red Pine Regional Sanitary Landfill.

Ash from the combustion of hog fuel is generated at a rate of about 10,000 m^3/year. The results of several chemical analyses of the ash, provided in Appendix II, indicate the ash contains a proportion of acid insolubles (silica) associated with the sand in the hog fuel as well as significant quantities of calcium, iron, magnesium, potassium, manganese, and sodium. The ash therefore has some fertilizer value (potassium) and potential as a soil conditioner (calcium). Visual observation indicates the ash to also contain significant amounts of unburned or charred wood and bark particles.

During the winter months some Bunker "C" fuel is combusted with the hog fuel. Over the span of twelve months 91% of the steam produced in the Mill boilers is generated from hog fuel and 9% from the burning of Bunker "C" fuel. There has not been any chemical testing carried out of the ash produced when hog fuel is combusted with Bunker"C". However, considering the small percentage of Bunker "C" burned on an annual basis it is felt that the overall composition of the 10 000 m^3 of ash generated annually will not be significantly different from the analyses presented in Appendix II. Stone will carry out additional analytical testing on ash from the combustion of hog fuel and Bunker "C" this winter.

2.3.2 Disposal Site Layout

It is intended that the new disposal site be designed as an [areal] landfill. The new site has been subdivided into six smaller cells, each approximately 0.5 hectares in area. The cellar design has been selected to minimize the exposed area to groundwater infiltration and precipitation, and to permit the partial closure of the site as development progresses. The total disposal site has been sized based on a daily ash production of 30 m^3 for 20 years. The final design provides a storing capacity of 219,000 m^3 of placed ash over an active area of approximately 4.5 ha. The individual cell height will vary between 9-12 m above existing ground level.

The new site has been located at the northeast corner of the 15 ha site as shown on Figure 2-1 so as to take maximum advantage of the site topography which slopes downward to the east at a 2-4% gradient in the area proposed for development. This is the optimum location for the new disposal site since the ground surface topography site is such that runoff will tend to flow towards the Nepisiguit River rather than west towards South Bathurst.

The new disposal site will be provided with a treed 50 m wide buffer zone on the east, south, and west sides to screen the site from nearby properties.

2.3.3 Disposal Site Liner

The new ash disposal site will be provided with an impermeable soil liner, designed to meet the minimum NBDOE permeability requirements for a landfill liner. The in situ silty clay material which will be used for liner construction will be recompacted to the required thickness on both the sides and over the base of each cell. The approval to construct/operate (ATC/O) issued under the Clean Environment Act will dictate or approve the final liner thickness.

The construction of the liner using the in situ silty clay will require the initial excavation of the surficial granular soil layer. Soil explorations (Roy, 1990) have shown a high water level perched within this granular deposit over the site. Prior to the cell excavation, a system of French drains around the periphery of the proposed site will be installed to lower the water level to below the base

of the liner. The water abatement systems will discharge into the sedimentation pond. In the event of localized dewatering insufficiencies, a drainage blanket between the slope and the liner may be added.

The Geotechnical Research Centre of McGill University (McGill) carried out physio-chemical characterization of two samples of the silty clay provided by Roy from the new disposal site to evaluate the soils suitability for use as a soil liner. The physical and chemical properties of the clay soil as they relate to liner construction, are summarized in Tables 2-1 and 2-2 respectively. The results of the McGill testing indicate that the hydraulic conductivity of the two clay soils tested will meet NBDOE requirements and that the hydraulic conductivity will not be significantly altered by the introduction of ash leachate. The liner will be provided with a free draining granular layer cover 0.3 m thick. The granular layer will act as a leachate collection layer while minimizing leachate mounding and hence minimize the hydraulic gradient across the liner.

2.3.4 Sedimentation Pond

Surface runoff waters will be diverted from the site by a system of open ditches and sewers to the proposed sedimentation pond to be constructed at the south end of the existing ash pile. The sedimentation pond will be designed to collect surface runoff from the new ash disposal site and a large part of the mill yard for a minimum 24 hour retention time for a 1 in 50 year 6 hour rainfall event. The 24 hour retention time is assumed to be sufficient for the settling out of sediments to below the NBDOE maximum allowable for discharge (25 mg/l). Additional testing will be carried out to confirm this.

The maximum flow to the sedimentation pond will be generated by surface waters in spring when the soil is saturated from the melting snow and high precipitation. During such adverse conditions, the flow may be as high as 6000 m^3/day from an area of 5 hectares.

Table 2-1
Physical Properties In situ Silty Clay

Properties		NB1	NB2
Liquid Limit (%)			
	with water	48.3	38.0
	with EXTRACT	50.9	38.8
Plastic Limit (%)			
	with water	26.6	22.3
	with EXTRACT	27.4	24.8
Optimum Moisture Content (%)		19.7	17.8
Max Dry Density. (g/cm^3)		1.73	1.76
% clay size particles		52.5	47.5
% silt size particles		41.3	49.0
K(cm/sec)	with water	[1.1 - 3.2] x 10^{-8}	[6.1-7.2] x 10^{-8}
	with EXTRACT	[0.92 - 1.3] x 10^{-8}	[6.6 - 7.7] x 10^{-8}
Surface Area (m^2/g)		163.0	109.9

* EXTRACT - Mixture of water and ash

Table 2-2
Chemical Properties In situ Silty Clay

Properties		NB1	NB2
Soil pH		5.5	7.5
Organic matter content. (%)		0.42	0.53
Amorphous content. (w/w)		4.39	4.44
Extractable Cations (meg/100g)	Na	49.20	33.80
	K	0.36	0.53
	Ca	0.78	1.40
	Mg	8.66	3.80
	Al	0.08	0.03
	Total CEC	59.10	39.60

Note: Samples NB1 and NB2 recovered by Roy from proposed new disposal site. Specific locations on site not known.

2.3.5 Leachate

2.3.5.1 Leachate Characterization

Leachate characterization testing was carried out in April, 1991 at Fenwick Laboratories (Fenwick) in Halifax. The results of this testing are provided in Table 2-3.

The two samples of biomass ash were delivered to Fenwick Laboratories where the Canadian General Standard Board Leachate Extraction Procedure (154-1MP), the method recommended by NBDOE, was followed to generate the ash leachate. One of the ash samples was taken directly from the ash discharge while a second sample was taken from the ash pile. Chemical analysis (MOE 309) were carried out on the ash leachate generated.

The chemical analysis of the simulated leachate indicates a high pH and a high concentration level of some heavy metals, particularly manganese and iron, surpassing that considered harmful to fresh water aquatic life. The quality of leachate collected from the disposal site, when diluted with runoff collected from within the cell, is expected to have lower concentrations of constituents than those in Table 2-3.

2.3.5.2 Leachate Collection

Ash leachate is any water which comes in contact with ash. All ash leachate will have to be collected and treated if required to meet discharge requirements.

The proposed disposal site leachate collection system consists of a series of perforated piping embedded in a layer of highly permeable granular material placed over the soil liner. The leachate lateral collection piping is interconnected and converges to a main collection pipe which will direct the collected leachate by gravity to a holding pond. The holding pond will provide temporary containment and allow for routine monitoring of leachate. Further treatment of the leachate will be provided if required. The pond will provide capacity to insure that any sudden change in leachate concentration cause only be a gradual change in concentration of such components in pond overflow. The holding pond will be designed in accordance with NBDOE requirements based on a design storm runoff of 1 in 25 years, 6 hour duration and a minimum pond retention capacity of 7 days.

The design of the leachate collection system has not been finalized. Preliminary design indicates a minimum spacing of lateral collection piping of 100 m. However, because of the close proximity to the Nepisiguit River, additional lateral collection piping will be provided for the two cells closest to the river. The details of the leachate collection system which will meet the requirements of NBDOE, will be provided in the application for a Permit to Construct. The ATC/O issued under the Water Quality Regulation, Clean Environment Act will dictate or approve the final leachate collection design.

The protection of the leachate collection system against clogging with fine particles will be achieved through the use of geotextile membrane with a layer of silty sand as the transition material. The use of a silty sand, which has permeability of 1×10^{-2} cm/s, around the drainage layer will prevent the migration of the ash particles, as well as reducing the percolation rate of leachate in the collection system.

2.3.5.3 Leachate Treatment

Leachate treatment will be provided, if required, to meet federal and provincial environmental guidelines. The treated leachate will meet the effluent discharge requirements of the ATC/O issued by NBDOE. The treated leachate will also be in compliance with the federal regulations of Pulp and Paper mill discharge. For the Stone mill the following will apply.

	Monthly Average	Daily Maximum
Total Suspended Matter	10710 kg	1780 kg
BOD_5	7140 kg	11900 kg

A non acutely toxic effluent will be required.

Table 2-3
Ash Leachate
Water Quality

Inorganic Analysis		Sample 1 Ash Discharge	Sample 2 Ash Pile
Initial pH		10 3	8 8
Final pH		9 8	5 25
0 5N Acetic acid volume	mL	200	200
Aluminum	ug/L	79	10
Antimony	ug/L	<2	4
Arsenic	ug/L	2	32
Barium	ug/L	1100	2900
Beryllium	ug/L	<5	<5
Boron	ug/L	450	880
Cadmium	ug/L	1 1	4 2
Calcium	mg/L	2240	2040
Chromium	ug/L	6	11
Cobalt	ug/L	6	15
Copper	ug/L	<2	<2
Iron	ug/L	1200	1100
Lead	ug/L	0 1	0 4
Magnesium	mg/L	0 2	11 3
Manganese	ug/L	3	22000
Mercury	ug/L	<0 5	<0 5
Molybdenum	ug/L	210	14
Nickel	ug/L	240	290
Potassium	mg/L	725	145
Selenium	ug/L	3	2
Silver	ug/L	<10	<10
Sodium	mg/L	90 6	51 3
Strontium	ug/L	4600	2800
Thallium	ug/L	<0 1	0 7
Tin	ug/L	<2	<2
Uranium	ug/L	<0 1	3 7
Vanadium	ug/L	250	44
Zinc	ug/L	3	140
Chloride	mg/L	329	9 4
Fluoride	mg/L	0 6	0 5
Ammonia (as N)	mg/L	0 39	0 52
Nitrite + Nitrite (as N)	mg/L	<0 05	<0 05
Sulfate	mg/L	1060	51
Percent Moisture	%	28 7	40 7
MOE 309 Leachate		Completed	Completed

* Canadian General Standard Board Leachate Extraction Procedure (154-Mp)
Fenwick Labratory, May 1991

2.3.6 Site Development

To meet current environmental regulations, the project will be designed to minimize the production of leachate, fugitive dust emissions, and erosion problems. To minimize the construction impacts primarily from site runoff, site development will be in the following order:

- construction of the sedimentation pond
- construction of drainage ditches
- construction of the access road
- construction of the first ash disposal cell

A new access road, passing to the west of the existing ash pile and adjacent to the existing water main, will be constructed to provide adequate access for the ash hauling equipment. A minimum of 300 mm of well graded material will be provided for the road subbase. Proper drainage ditches will also be provided to stabilize the road subgrade.

2.3.7 Final Cover

The final cover will be placed on the top of the ash disposal site for sealing purpose at the completion of each cell. The final cover will meet the current NBDOE guidelines for capping, that is a 500 mm thick layer of clay with a maximum permeability of 1×10^{-7} cm/sec or equivalent sandwiched between an underlying 150 mm thick grading layer and a 500 mm thick granular soil cover. A layer of top soil is required over the granular cover to permit the growth of vegetation.

2.4 NEW ASH DISPOSAL SITE OPERATION

2.4.1 Ash Transportation

The ash which is presently wetted down as it is being conveyed from the boilers will be discharged at the Ash Loadout area at the main mill complex on the north side of Bridge Street. Two to three times per day this ash will be loaded onto Stone trucks with a pay loader for transport to the new ash disposal site. The trucks will have a capacity of 15 m^3 and will be equipped with specially designed covers so that the ash will be entirely confined during transport. The transport

of the ash will be entirely on Stone property over a new all-weather road.

2.4.2 Ash Placement

The disposal site will be designed as an areal landfill with ash deposited at the site in controlled layers. The general sequence of placement will be in a north/south direction in layers about one metre thick and 3-4 metres wide. At least once per week the ash will be spread and a 10-15 mm layer of sand and gravel covering placed, principally for dust control. Layer surfaces will also be graded to control runoff and minimize erosion. Uniform grading and proper maintenance will prevent water from ponding. The compaction of the placed ash will be limited to the passage of trucks and grading equipment.

The final disposal site area will be provided with an approved NBDOE cover and provided with a self sustaining vegetative cover at the completion of each cell. The final cover will be placed as the waste reaches design elevation to minimize leachate generation.

2.4.3 Dust Suppression

As the cell filling progresses, dust control will be maintained by the regular placement of a sand and gravel cover. During the dry summer months, watering of the surface of the ash pile with tankers may also be required. In the winter months, provision will be made to cover the uncapped area with granular material. The final cover will be placed as the sections of the cell are filled. The 50 m wide tree buffer zone planted around the entire site will also serve as a dust control measure in addition to its aesthetic value. The tree buffer will comprise principally of conifers resistant to the ash which may be blown.

3.0 EXISTING ENVIRONMENT

3.1 INTRODUCTION

It is impossible for an impact assessment to address in detail all potential environmental effects of a project (Beanlands and Duinker, 1983). It is, therefore, accepted practice to focus on those environmental factors which include the geophysical, biophysical and socioeconomic setting considered to be important or sensitive to the proposed development. In this report these environmental factors are referred to as Valued Environmental Components. The assessment of the Valued Environmental Components is carried out within boundaries defined by spatial and temporal constraints.

3.1.1 Valued Environmental Components

In carrying out the EIA, the specific interaction between closure of the existing disposal site, development and operation of the new ash disposal site and the Valued Environmental Components was studied. The Valued Environmental Components include both the Valued Ecosystem Components (VEC) and the Valued Socioeconomic Components (VSC). The final selection of Valued Environmental Components for this study was based on the following:

- identification in the EIA Guidelines
- identification in the public consultation process
- professional judgement.

The Guidelines for the study specifically identified the following VECs:

- groundwater quality
- surface water quality
- aquatic life
- vegetation
- wildlife particularly local deer population

No additional VEC's were identified during the study.

The Valued Socioeconomic Components (VSC) for this study are the socioeconomic issues of greatest concern to the community within the Study Boundaries. The identified VSCs may interact either with other VSCs or with the Valued Ecological Components.

The Guidelines for the study specifically identified the following VSCs:

- human health and safety
- transportation impacts
- community with respect to aesthetics, odour, dust, litter, noise
- commercial, recreational uses
- property value
- land use

Public consultation during the EIA did not result in additional VSCs being considered.

3.1.2 Study Boundaries

An important aspect of the environmental assessment process is the determination of the study boundaries. The four types of temporal and spatial boundaries considered in carrying out the EIA are administration, project, ecological and technical.

Administrative Boundaries

Administrative boundaries are time and space limits imposed on the assessment for political, social or economic reasons. An important temporal administrative boundary is the time available for conducting this EIA study. To meet the planned project schedule the study was conducted over a three month span commencing March 13, 1991. The study was based on available information. However, additional samples of both surface water and groundwater were collected and tested.

The project is located entirely within the city limits for Bathurst and thus must meet all city official plans (primary and secondary), and bylaws. Provincial departments with direct

administrative mandates include the departments of Natural Resources and Energy, Environment, Fisheries and Municipal Affairs. Federally, the Canadian Wildlife Service and Fisheries and Oceans Canada have administrative responsibilities.

Project Boundaries

The spatial project boundaries are limited to the Stone property except for groundwater and surface water which extend outside the Stone property. The temporal project boundaries will extend over the next twenty years, the life of the new ash disposal site. The time span for activities which occur within this time frame will be highly variable. The operation and maintenance activities will be on a regular schedule over the next 20 years. The construction of each of the six cells will be on an intermittent basis over the next 20 years with each cell being developed as the proceeding cell reaches capacity. The time frame for cell construction is generally less than 3 months. The closure of the existing site will be very short duration, less than six months.

Ecological Boundaries

It is envisioned that most of the effects of the proposed development, with respect to the terrestrial environment, will be confined to Stone property. The only effects that would be expected to reach beyond the Stone property boundary are the effects of dust and noise. Measures will be taken to minimize dust generation during the construction and operating phase of the project. For the most part, noise will be associated with construction activities and therefore will be of a temporary and intermittent nature.

The aquatic environment will ultimately receive the leachate (treated or untreated) from both the proposed ash disposal site and the closed site, and therefore is the ecosystem most potentially at risk from the proposed development. The study area boundary for the aquatic environment will include the Nepisiguit River, from the section of river between the Highway 11 bridge and the mouth of the river at its confluence with Bathurst Harbour, as well as Bathurst Harbour itself. The upstream boundary (Highway 11 bridge) is beyond the limit of any possible movement of the leachate, or any effects of the leachate, in the aquatic environment by wind, wave or tidal action

(IEC Beak, 1985).

Technical Boundaries

The technical boundaries are defined by the limitations in the ability to predict and monitor impacts to both the biophysical and socioeconomic settings.

The information available with regard to groundwater and the aquatic environment is principally baseline data and hence limits the refinement for the prediction of the impacts. As a result, the predicted impacts will require monitoring programs to verify.

The technical boundaries of the socioeconomic impacts of the project arise from the limited available baseline data on such aspects as community perception with respect to odour, dust, litter and noise and commercial and recreation uses of the site. The study team has used the public consultation process to obtain a subjective measure of this boundary.

3.2. CLIMATOLOGY

The climate of northeastern New Brunswick in the Bathurst area lies within an area of climatic influence originally designated by Putnam (1940) as the "Northern New Brunswick Climatic Region." The climate of this region is noticeably colder than most other regions of the Maritimes. More recently, Dickison and Steeves (1989) have recognized an effect of coastal influence throughout this area and have renamed the area of climatic influence (which includes the study area) as the East Coast Climatic Region.

Temperature and precipitation data shown in Table 3-1 are from the Bathurst Atmospheric Environment Service (AES) station. The nearest station for which wind data are available is Belledune located about 30 km west of Bathurst on the Bay of Chaleur. This weather station has only been in operation eight years.

NEW BRUNSWICK/NOUVEAU-BRUNSWICK

	JAN JAN	FEB FEV	MAR MAR	APR AVR	MAY MAI	JUN JUIN	JUL JUIL	AUG AOUT	SEP SEPT	OCT OCT	NOV NOV	DEC DEC	YEAR ANNEE	CODE CODE	
BATHURST 47° 37' N 65° 39' W 12 m															
Daily Maximum Temperature	-5.2	-3.7	0.9	7.6	14.7	20.9	24.5	23.2	18.4	11.9	4.7	-2.5	9.6	3	Temperature Maximale Quotidienne
Daily Minimum Temperature	-14.9	-15.0	-8.9	-2.0	3.3	9.0	13.0	11.6	7.0	2.4	-2.8	-11.4	-0.7	3	Temperature Minimale Quotidienne
Daily Temperature	-10.1	-9.4	-4.0	2.8	9.0	15.0	18.8	17.4	12.7	7.1	1.0	-7.0	4.4	3	Temperature Quotidienne
Standard Deviation, Daily Temperature	3.2	2.6	2.1	1.1	1.3	1.1	1.7	1.2	1.3	1.0	1.5	2.8	0.6	3	Ecart Type de la Temperature Quotidienne
Extreme Maximum Temperature	15.6	12.2	18.3	29.4	33.3	36.1	37.2	37.2	35.0	32.2	22.2	16.1	37.2		Temperature Maximale Extreme
Years of Record	42	42	43	40	43	45	45	44	42	47	45	42			Annees de Releves
Extreme Minimum Temperature	-37.2	-34.4	-28.9	-21.7	-9.4	-2.2	0.0	-3.3	-7.8	-17.8	-25.0	-36.9	-36.9		Temperature Minimale Extrême
Years of Record	43	42	44	41	43	45	45	43	42	47	45	42			Annees de Releves
Rainfall	18.1	18.4	21.0	41.9	72.6	72.4	83.8	88.3	75.6	79.1	64.7	27.4	663.3	3	Chutes de Pluie
Snowfall	63.8	54.5	57.8	23.4	2.8	0.0	0.0	0.0	0.0	2.2	22.3	55.8	282.6	3	Chutes de Neige
Total Precipitation	82.4	72.9	78.8	65.3	75.4	72.4	83.8	88.3	75.6	83.4	87.0	83.2	946.5	3	Precipitations Totales
Standard Deviation, Total Precipitation	48.3	36.3	38.2	33.3	31.7	29.8	42.4	51.9	32.9	35.9	30.5	36.3	133.5	3	Ecart Type des Precipitations Totales
Greatest Rainfall in 24 hours	79.8	67.8	61.0	57.2	58.4	69.6	107.2	132.1	84.1	61.0	71.4	51.8	132.1		Chute de Pluie Record en 24 heures
Years of Record	78	78	70	66	66	68	72	75	71	69	69	75			Annees de Releves
Greatest Snowfall in 24 hours	61.0	61.0	71.1	30.5	15.2	0.0	0.0	0.0	T	22.6	33.0	61.0	71.1		Chute de Neige Record en 24 heures
Years of Record	71	67	69	71	79	80	82	84	81	75	71	70			Annees de Releves
Greatest Precipitation in 24 hours	79.8	67.8	71.1	57.2	58.4	69.6	107.2	132.1	84.1	61.0	71.4	61.0	132.1		Precipitation Record en 24 heures
Years of Record	71	68	66	65	66	68	72	75	72	72	64	69			Annees de Releves
Days with Rain	2	2	3	8	12	12	13	12	11	10	9	3	97	3	Jours de Pluie
Days with Snow	9	8	8	3	1	0	0	0	0	1	3	8	41	3	Jours de Neige
Days with Precipitation	11	9	10	10	12	12	13	12	11	10	11	11	132	3	Jours de Precipitation
BATHURST 47° 37' N 65° 39' W 5 m															
Daily Maximum Temperature	-5.6	-4.2	0.6	6.8	14.7	21.6	24.5	23.0	18.1	11.6	4.4	-3.1	9.4	6	Temperature Maximale Quotidienne
Daily Minimum Temperature	-14.3	-14.2	-8.2	-1.9	4.0	10.4	13.9	12.6	8.3	3.2	-2.1	-11.1	0.1	6	Temperature Minimale Quotidienne
Daily Temperature	-10.0	-9.3	-3.8	2.5	9.4	16.0	19.2	17.8	13.2	7.4	1.2	-7.1	4.7	6	Temperature Quotidienne
Standard Deviation, Daily Temperature	1.6	1.2	1.8	1.1	1.4	1.5	1.2	0.6	0.9	1.0	1.7	2.4	0.7	6	Ecart Type de la Température Quotid
Extreme Maximum Temperature	12.0	11.7	19.0	23.3	32.2	33.4	33.9	35.0	29.0	25.0	19.4	10.0	35.0		Temperature Maximale Extrême
Years of Record	8	9	8	9	9	9	9	9	9	9	9	8			Annees de Releves
Extreme Minimum Temperature	-36.1	-30.0	-27.2	-16.0	-6.1	1.1	5.6	2.2	-3.3	-8.3	-18.0	-28.9	-36.1		Temperature Minimale Extrême
Years of Record	8	9	8	9	9	9	9	9	9	9	9	8			Annees de Releves
Rainfall	25.8	14.6	20.2	45.2	72.0	68.1	81.1	91.9	67.2	86.3	63.8	29.3	665.5	6	Chutes de Pluie
Snowfall	66.5	56.6	69.8	29.4	1.8	0.0	0.0	0.0	0.0	1.5	23.8	68.7	318.1	6	Chutes de Neige
Total Precipitation	97.8	70.9	94.8	77.4	74.3	68.1	81.1	91.9	67.2	87.9	88.5	100.0	999.1	6	Precipitations Totales
Standard Deviation, Total Precipitation	43.8	24.2	27.5	43.7	42.9	30.2	54.7	45.0	32.2	47.7	26.4	34.3	138.3	4	Ecart Type des Precipitations Totales
Greatest Rainfall in 24 hours	18.3	32.0	22.9	39.9	69.6	38.1	56.1	88.6	89.7	66.5	39.8	38.9	89.7		Chute de Pluie Record en 24 heures
Years of Record	16	16	15	16	16	16	17	17	17	17	17	16			Annees de Releves
Greatest Snowfall in 24 hours	38.4	45.7	45.7	61.0	12.7	0.0	0.0	0.0	0.0	7.6	30.5	40.6	61.0		Chute de Neige Record en 24 heures
Years of Record	16	16	15	16	16	16	17	17	17	17	17	16			Années de Releves
Greatest Precipitation in 24 hours	38.4	45.7	45.7	61.0	69.6	38.1	56.1	88.6	89.7	66.5	39.8	43.9	89.7		Precipitation Record en 24 heures
Years of Record	16	16	15	16	16	16	17	17	17	17	17	16			Annees de Releves
Days with Rain	2	1	4	8	12	12	12	12	11	11	9	3	97	6	Jours de Pluie
Days with Snow	11	9	9	5	1	0	0	0	0	1	5	11	52	6	Jours de Neige
Days with Precipitation	12	10	12	11	12	12	12	12	11	11	12	13	140	6	Jours de Precipitation

NOLAN, DAVIS & ASSOCIATES

TABLE 3-1

CLIMATOLOGY

BATHURST AREA

3.2.1 Precipitation

The average mean annual precipitation for Bathurst is 999.1 millimetres.

Rainfall is seasonally well distributed. Minimum precipitation occurs from April through September. The months of May, August and October are periods with a slightly higher incidence of intense storm events. However, most precipitation events are prolonged and of low intensity.

Maximum monthly precipitation occurs during the fall and early winter period from October through to January. Precipitation during this period is usually of long duration and low intensity and is generally created by frontal convergence of tropical and arctic air masses.

3.2.2 Air Temperature

The mean annual air temperature in Bathurst is 4.7^0 C, with a standard deviation of 0.7^0 C. Air temperature is strongly dominated by the seasonal cycles, with daily fluctuations in the order of 10^0 C.

Mean monthly temperatures below freezing occur from December through March. The mean minimum of -10.0^0 C occurs in January. Average daily temperatures peak in July (19.2^0 C).

3.2.3 Wind

Large-scale wind patterns are generally consistent throughout most parts of the province. Wind speed and direction can, however, be significantly modified by local topographic effects and surface cover (vegetation, water, etc.). Coastal locations such as Bathurst are often affected by sea breezes (diurnal onshore/offshore air flow caused by differential heating of the land mass and the ocean). An open water fetch will also tend to slightly increase the wind speed from the offshore direction in coastal locations.

Wind data sites were not available for the Bathurst area. The two closest areas for which data was available were Belledune and the Brunswick Mine Site. Because the Belledune station has a reliable period of wind record, and because of similarities in proximity to the ocean, it was selected as the station representative of the conditions at Bathurst.

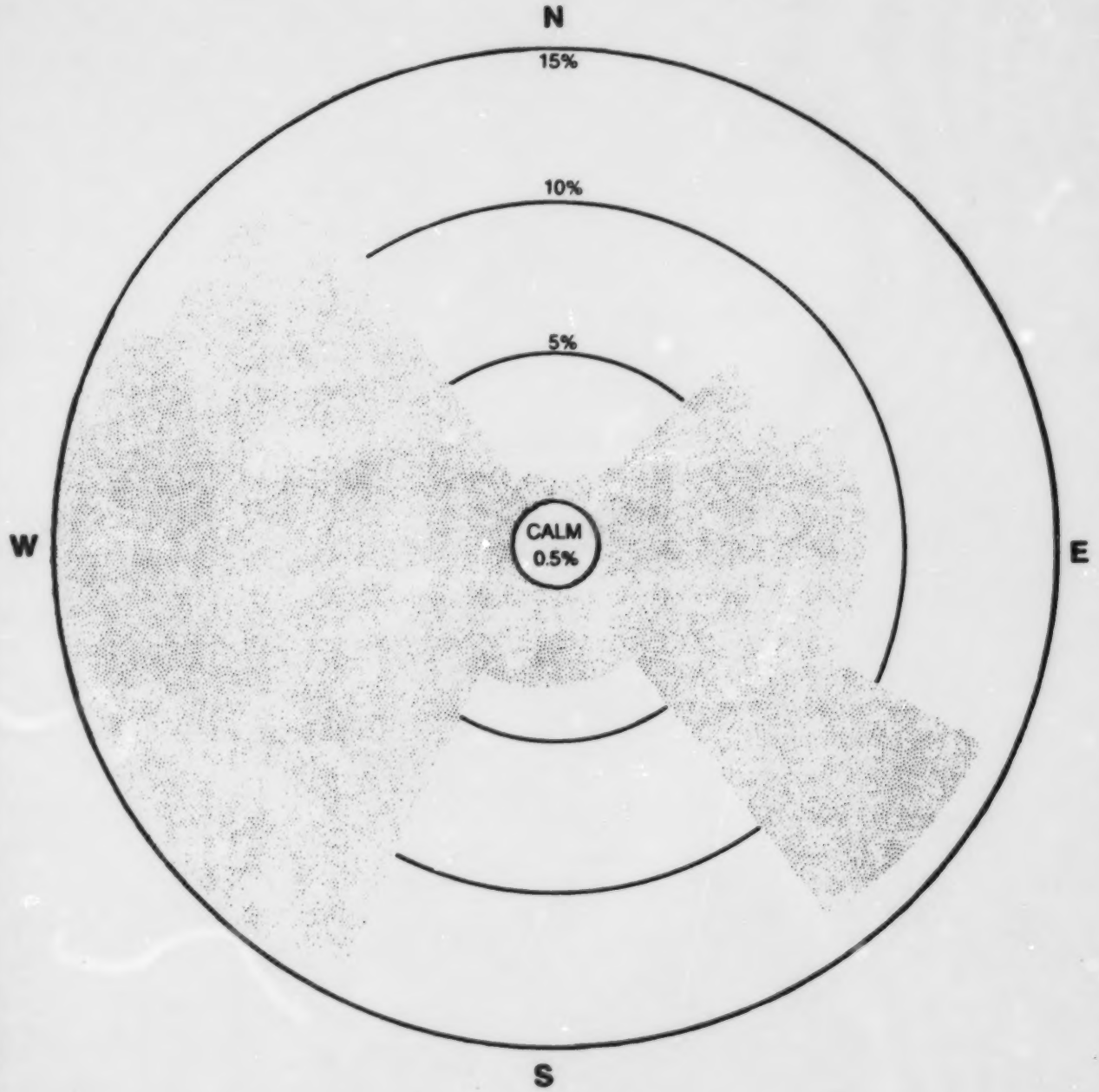
The Belledune wind record is shown graphically on Figure 3-1. The wind rosette indicates westerly winds prevail although there is a significant southeast wind.

3.3 GEOLOGY

3.3.1 Surficial Geology

The surficial geology underlying the lime sludge, bark and ash, of the present disposal site, based on the results of previous geotechnical investigations in the area (Geocon, 1988; Nolan Davis, 1991), consists of a localized granular deposits overlying fine grained clayey silt to silty clay. The thickness of the clayey silt to silty clay varies from 11.6 m near the Chip Reclaimer to about 1.3 m near the riverbank in the area of the existing Waste Water Treatment Plant. The silt and clay is underlain by a dense glacial till soil ranging up to 6.7 m in thickness. The composition of the till is highly variable with sand and gravel content increasing with depth. The clay size particle content is greater than 50% for the upper levels of the stratum but decreases to less than 25% with depth. The transition of the glacial till is variable over the site.

The results of twelve boreholes put down throughout the new ash disposal site (Roy, 1990)



NOLAN, DAVIS & ASSOCIATES

FIGURE 3-1

WIND DIRECTION AT BELLEDUNE

indicate the surficial geology of most of the new landfill site (Roy, 1990) to consist of 2-6 m of sand and gravel overlying the silty clay. Along the eastern portion of the site, the in situ silty clay is encountered near the ground surface. The thickness of the silty clay varies from 2.5 m along the east side of the site to 11 m at the west side. The silty clay in turn is underlain by glacial till which varies in thickness across the site from 1.5 to 4.3 m.

A detailed analysis of the physio-chemical nature of two representative samples of silty clay from the site of the proposed new disposal facility, was carried out at McGill. The results of the McGill testing indicate the soil is mineralogically comprised of 50% illite, 20-25% montmorillonite and 15-20% quartz. Chlorite and kaolinite were also noted in one sample. Montmorillonite, kaolinite, and to a lesser extent chlorite have an affinity for cations and will tend to adsorb them out of groundwater passing through the soil. The cation-exchange capacity (CEC) of the silty clay, which is a measure of the ability to absorb cations, is 40 to 60 meq/100g. The results of the McGill testing indicate the in situ silty clay will act as an effective barrier against the downward migration of leachate from the new disposal site.

The silty clay soils tested are presumed to be the same soils found underlying the existing disposal site during previous geotechnical investigations (Geocon, 1989).

3.3.2 Bedrock Geology

The Stone property is underlain by sedimentary bedrock of the Pennsylvanian Age. At the existing disposal site previous investigations encountered reddish brown siltstone, sandstone and occasional conglomerate at elevation 6 to 8 m. The surficial zones of the rock are frequently soft and highly fractured (Geocon, 1989).

The underlying bedrock encountered at the new landfill site is a shale and is highly fractured at the rock surface (Roy, 1990).

3.3.3 1859 Mining Operations

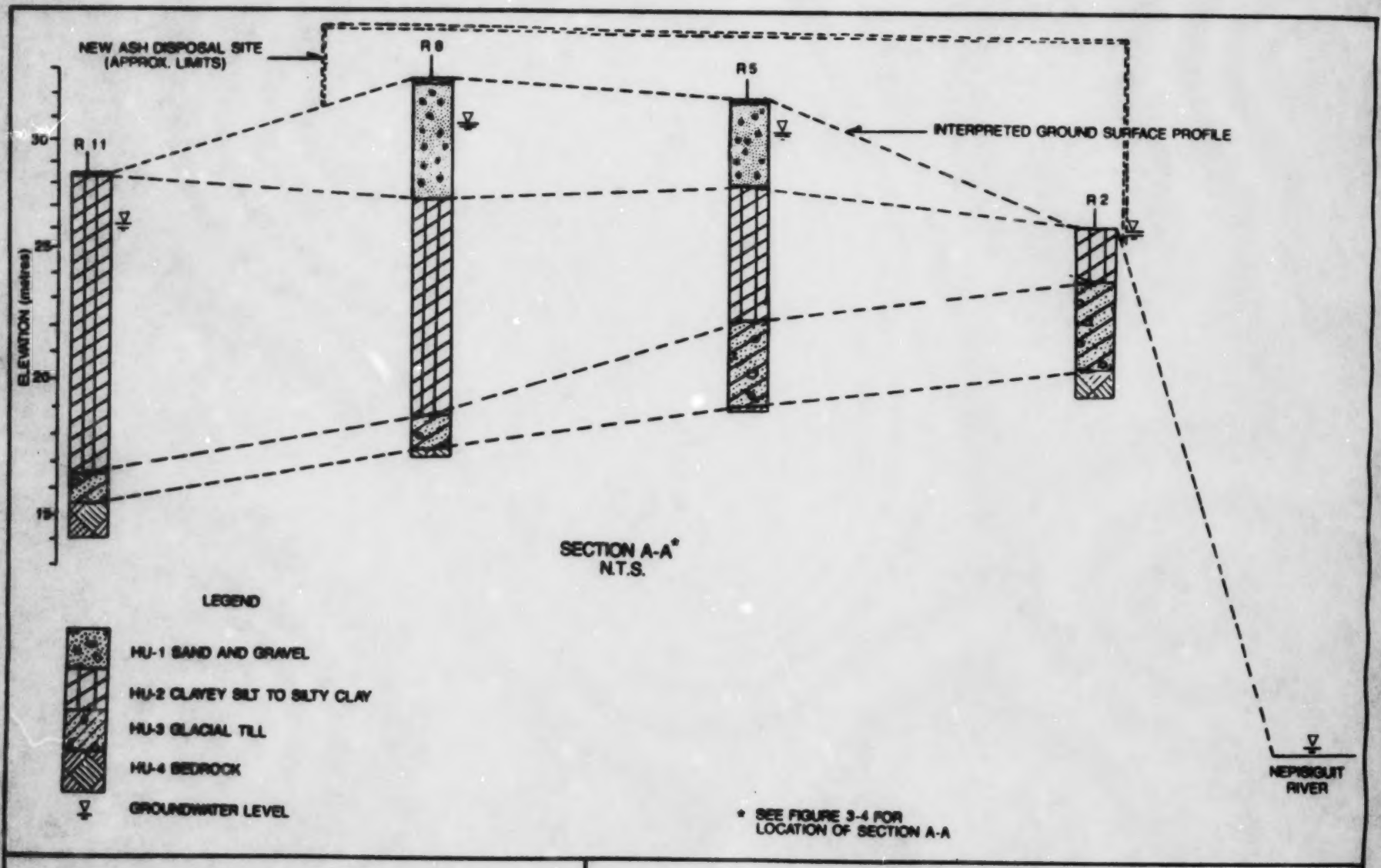
According to the owners of the land of the proposed site, mining exploration was conducted in the area in 1859. The shaft entrances were possibly located on the south site of the existing lime pile along the river bank. A provincial Mines Branch report (Wright, 1950) confirms that mining operations occurred in the area about 1 mile above the bridge on the highway that leads from Bathurst to Newcastle. Available information indicates that the mining operations were small scale with only 20-30 tonnes of material shipped. The vagueness of the location information has prevented the study team from identifying the exact mine location.

3.4 HYDROGEOLOGY

3.4.1 Hydrostratographic Units

The hydrogeology of the study area has been characterized based on available borehole data from both the new ash disposal site (Roy, 1990) as well as with information from previous geotechnical investigations on the existing Stone property (Geocon, 1989; Nolan, Davis, 1991). The hydrogeology can be defined in terms of four hydrostratigraphic units, which are groups of earth materials having similar water storage and transmission capability properties. The four units are the sand and gravel, the clayey silt to silty clay, the glacial till and the bedrock and are discussed below. The recent fill soils, which overlie the formations described below, are generally above the water table and are not designated as a hydrostratigraphic unit. Interpreted geohydrologic sections through the proposed new disposal site and existing disposal site and Mill yard are shown on Figures 3-2 and 3-3 respectively.

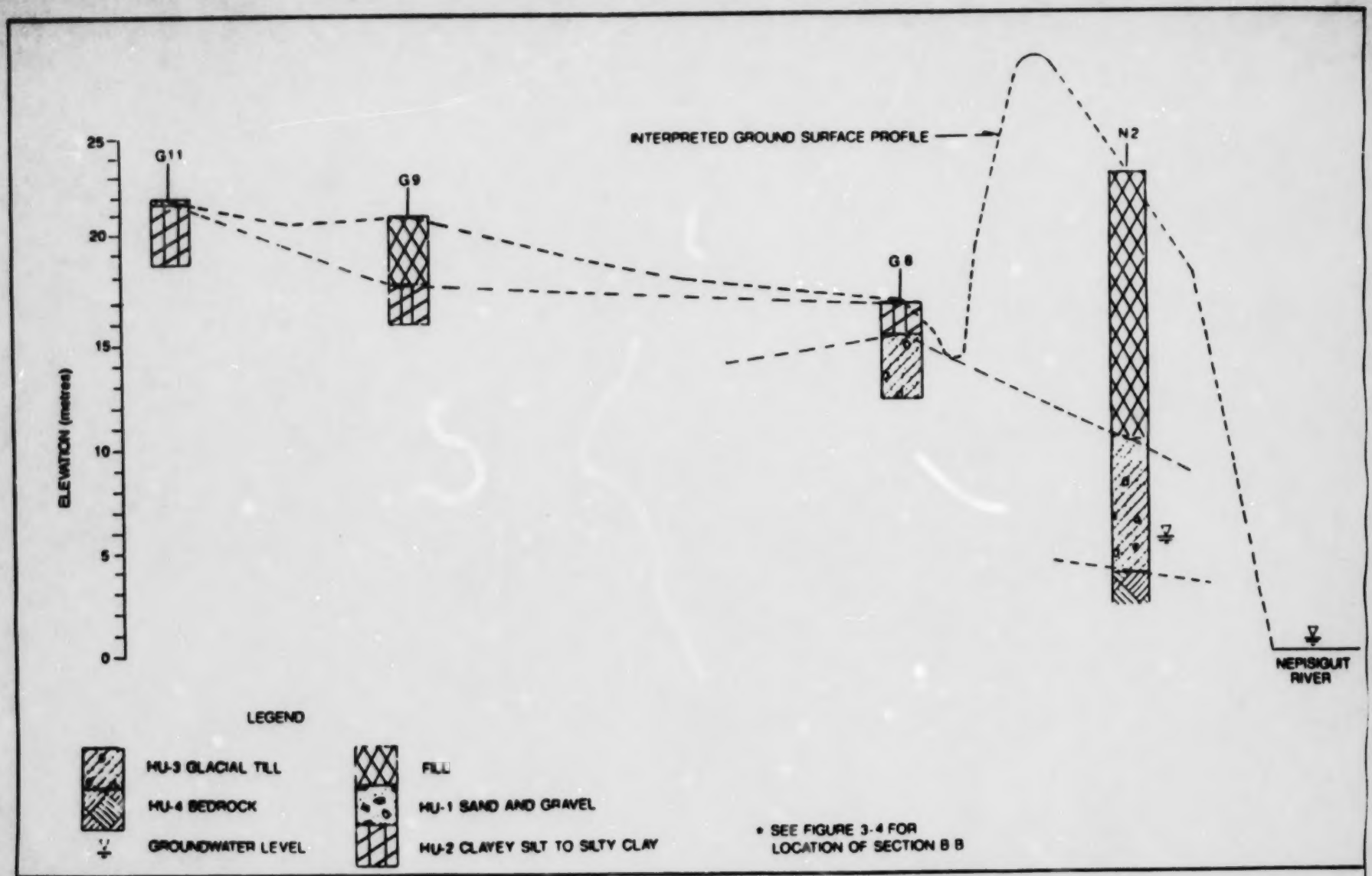
Hydrostratigraphic Unit-1 (HU-1) consists of a surficial sand and gravel deposit generally found at elevations above approximately 26.8 m. From the information available from the boreholes at the new ash disposal site, the base of the unit is believed to be horizontal and relatively planar with localized lower areas, possibly a result of channelling into the formations below. The permeability of this formation will be high in the order of 10^{-2} to 10^{-3} cm/sec. The deposit is believed to represent the sand and gravel formation identified as covering the Wisconsian Marine blankets and plains deposits which make up the underlying hydrostratigraphic unit (Rampton, 1984).



NOLAN, DAVIS & ASSOCIATES

FIGURE 3-2

INTERPRETED GEOHYDROLOGIC SECTION
PROPOSED ASH DISPOSAL SITE



NOLAN, DAVIS & ASSOCIATES

FIGURE 3-3
INTERPRETED GEOHYDROLOGIC SECTION
EXISTING ASH DISPOSAL SITE
AND MILL YARD
SECTION B-B'

Hydrostratigraphic Unit-2 (HU-2) consists of clayey silt to and silty clay. The finer sediments appear to grade laterally into the coarser and cleaner sediments. HU-2 has been mapped as Wisconsian Marine blankets and plains sediments and is noted as being of above average thickness (up to 100m) in the Bathurst area (Rampton, 1984). The thickness of HU-2 varies across the site ranging from 8 to 12 m under the new disposal site and 10 m under the existing site. The base of HU-2 is quite irregular over the Stone site. Permeability testing carried out both in situ and on laboratory samples of HU-2 indicate low hydraulic conductivities ranging from 8×10^{-8} to 6×10^{-10} cm/s.

Hydrostratigraphic Unit-3 (HU-3) is a dense to very dense Wisconsian glacial till found underlying the silty clay. When unfractured, dense fine grained tills have extremely low hydraulic conductivities in the range 10^{-9} to 10^{-10} cm/s. However, fracturing and penetration of the glacial till by roots may increase their hydraulic conductivity by 1 to 3 orders of magnitude (Freeze, 1979). One permeability test was performed on this formation from which a hydraulic conductivity of 6.5×10^{-7} cm/s was calculated. HU-3 uniformly overlays the surface of the Pennsylvanian Bathurst Formation.

The basal Hydrostratigraphic Unit-4 (HU-4) underlying the glacial till is the sedimentary bedrock of the Pennsylvanian Bathurst Formation (Skinner, 1972) consisting of reddish brown sandstone, siltstone and conglomerate. Available borehole data indicates the surface of HU-4 to be variable across the site having a gently undulating surface. The bedding planes of the unit have been mapped as horizontal (Skinner, 1972). Bedrock outcrops along the river bank below the existing disposal site at about an elevation of 6 m. Previous testing indicated the hydraulic conductivity was in the range 5.0×10^{-3} to 1.4×10^{-5} cm/s. The presence of fractures in this unit will enhance any permeability resulting from primary porosity.

3.4.2 Flow Systems

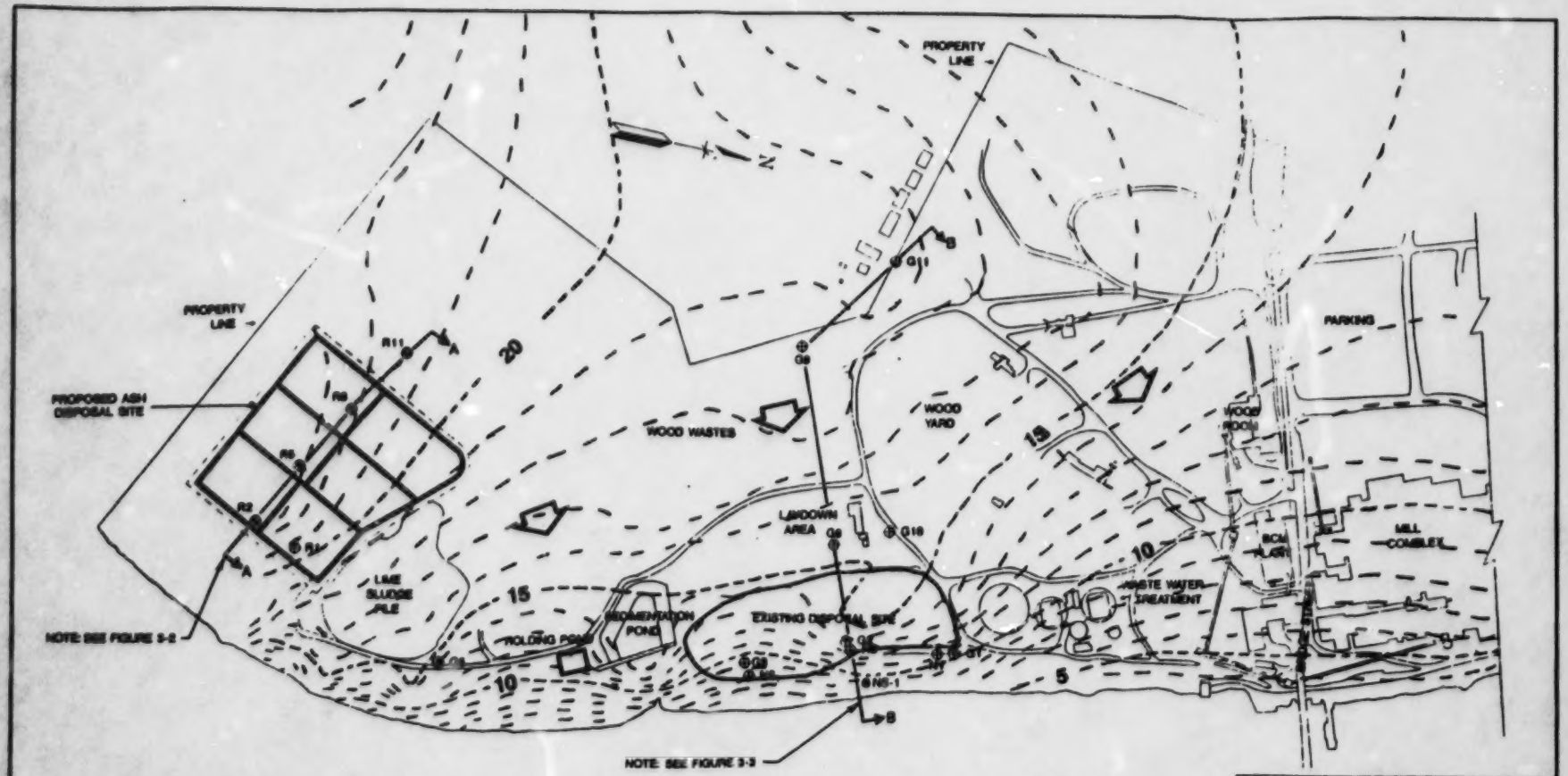
In general terms, the groundwater flow under the Stone Property is controlled by two dominant systems, namely the perched aquifer in the surficial sand and gravel of HU-1 and a confined or semi- confined aquifer in the bedrock (HU-4). The glacial tills of HU-3 and the silty

clays of HU-2 separate the two systems. The flow system of the perched aquifer exerts the dominant hydrogeological influence on the Stone site. There is some doubt about the nature of the semi-confined aquifer as most of the available piezometric readings from HU-4 are close to the river bank, along which the bedrock outcrops. It is quite likely that much higher piezometric levels are to be found west, away from the river bank.

Figure 3-4 shows the inferred water table contours across the site as determined using the MODFLOW computer modelling program. The program was calibrated with available information on the vertical variations between static water levels measured in piezometers across the site and the lateral distances between the piezometers. The input parameters for MODFLOW model included the hydraulic conductivity (K), unit thickness, and leakance or vertical hydraulic conductivity for each of the four hydostratigraphic units. The unit thickness of each hydrostratigraphic unit was determined using topographic mapping, available borehole data and a separate computer program, SURFER. A preprocessor software package MODELCAD was used to compute leakance or vertical hydraulic conductivity. The assumed hydraulic conductivity for each unit was:

HU - 1	SAND AND GRAVEL	1×10^{-1} cm/s
HU - 2	SILTY CLAY	1×10^{-8} cm/s
HU - 3	GLACIAL TILL	1×10^{-9} cm/s
HU - 4	SANDSTONE BEDROCK	1×10^{-3} cm/s

The initial head assumptions required for MODFLOW assumed block centered flow (parameters within a block are represented by a point in the centre of the block). The boundary condition along the northern edge of the model grid was set with constant head cells to represent a "flow" of water from upgradient. Recharge areas and the Nepisiquit River were assumed to be at a constant head equal to the river surface elevation. The initial head assumptions and boundary conditions were also defined in MODELCAD.



LEGEND

- ⊕ RI - NOLAN, DAVIS MONITORING WELL
- ⊕ GI - GEOCON MONITORING WELL
- ⊕ RI - ROY CONSULTANTS MONITORING WELL
- ⊕ R2 - ROY CONSULTANTS BOREHOLE
- ⊕NS-1 NOLAN, DAVIS SEEPAGE SAMPLE
- DIRECTION OF GROUNDWATER FLOW
- CALCULATED GROUNDWATER CONTOUR (ELEVATION m GEODETIC)

FIGURE 3-4
STONE CONSOLIDATED INC.
BATHURST N.B.
SITE HYDROGEOLOGY

NOLAN, DAVIS & ASSOCIATES

DRAWN by: AWG	CHECKED by: MDR
DATE: JUNE 1991	PROJECT No. F91-050

The results of the computer modelling confirm that the regional groundwater flow direction in the perched aquifer is away from the areas of residential properties at the west of the Stone Property and toward the river. Local areas of groundwater flow away from the river occur, especially in the area of water table mounding under the existing disposal site, but any back flow will be caught up in the main groundwater flow towards the river.

3.4.3 Groundwater Quality - General

Water sampling of groundwater was conducted as part of both previous studies (Geocon, 1989), and the present study. The water samples recovered during previous site studies were analyzed for a limited suite of anions and cations. Analyses performed on samples taken as part of this study involved a more comprehensive suite of analyses, including analyses of unfiltered samples and analyses for Poly-chlorinated Biphenyls (PCB's). A synopsis of the results of recent analytical testing is provided on Tables 3-2 and 3-3.

Filtration of groundwater samples eliminates particulate matter in water that may bind and precipitate metals out of solution. Consequently analytical testing was carried out on both filtered and unfiltered groundwater samples. The results of unfiltered sample analyses reflect the chemistry of local soils and qualitatively show the affinity of local soils for certain cations. The two test results of unfiltered samples from R1 presented in Table 3-2 are time series samples and reflect water quality at R1 after additional bailing of the same piezometer.

As noted in section 3.4.2, the hydraulic gradient across the Stone site is strongly towards the river, away from any residential area. The strongly directional hydraulic gradient allows for sampling of both contaminated (leachate) and uncontaminated (background) groundwater from piezometers located on the Stone Property. The chemical analysis presented in Table 3-2 are of water samples believed to be uncontaminated by site activities and are therefore considered site background water quality data. The chemical analysis test results presented in Table 3-3 are from piezometers installed through the existing Stone disposal site and are likely to reflect the leachate chemistry from the disposal pile. Also shown in Table 3-3 are the analytical test results for Sample NS-1, a water sample recovered from a seep on the river bank below the existing disposal site. This sample is also

TABLE 3 2

GROUNDWATER QUALITY BACKGROUND

		Unfiltered Samples					Filtered Samples		
Parameter	Units	G5	G11	G10	R1	R1	G11	G10	R1
Aluminum	mg/L	<0 01	0.66	<0 01	85 8	68 7	<0.01	<0.01	<0.01
Barium	mg/L	0 02	0.03	0 1	0.82	0.64	0 02	<0.01	0.05
Calcium	mg/L	0.72	56.26	55 42	39 2	36 7	54 4	0.56	19.39
Cadmium	mg/L	<0.01	<0.01	0.02	0.13	0.1	<0.01	<0.01	<0.01
Cobalt	mg/L	0.04	0.06	0.05	0.33	0.29	0.02	0.02	0.02
Chromium	mg/L	0.24	0.22	<0.01	1.87	1.94	0.13	0.14	0.12
Copper	mg/L	0.01	<0.01	0.02	0 48	0.42	<0 01	<0.01	<0.01
Iron	mg/L	0.08	0.82	13.6	7.7	164 4	<0.01	<0.01	<0.01
Lead	mg/L	<0.01	0.098	0.3	1.2	0.97	0.07	0.1	0.1
Magnesium	mg/L	0.08	21.04	20.3	39 9	31.8	20.2	<0.01	3.81
Manganese	mg/L	0.06	3.26	8.01	5.26	4.16	3.17	<0.01	0.2
Mercury (ppb)	ug/L	0.16	<1	<1	2.8	4	<1	<1	<1
Nickel	mg/L	0 06	0.02	0.07	0.78	0.7	<0.01	0.06	<0.01
Potassium	mg/L	0.11	1.33	15.03	13 5	9.69	0.77	<0.01	2.93
Sodium	mg/L	<0.01	30 4	141.9	238 6	178 7	27.5	0.02	216.2
Vanadium	mg/L	0.05	<0.01	0.72	0.78	<0.01	<0 01	<0.01	<0.01
Zinc	mg/L	<1	0.21	0.07	1.2	0.66	<0.01	0.12	<0 01
Ammonia as N	mg/L	0.2	0.13	1.9	<0 1	<0 1	<0 1	1.8	<0 1
Nitrate as N	mg/L	<0 14	-	<0 14	<0 14	<0 14	<0.14	<0.14	<0.14
Chloride as Cl	mg/L	49 7	-	50 5	-	-	30	50 2	-
Sulphate as SO4	mg/L	144	-	56	-	-	40	56	-

TABLE 5-3
GROUNDWATER QUALITY - LEACHATE
EXISTING DISPOSAL SITE

		Filtered Samples(1)				Unfiltered Samples(2)		Guidelines for Canadian Drinking
Parameter	Units	N1	N2	N3	NS 1	N1	N2	Water Quality(3)
Aluminum	mg/l	<0.01	<0.01	0.96	<0.01	<0.01	<0.01	
Barium	mg/l	0.64	0.13	0.02	0.92	0.26	0.21	1.0
Calcium	mg/l	78.7	28.86	16.5	88.6	19.0	182	
Cadmium	mg/l	0.16	0.15	0.04	0.05	<0.01	<0.01	5.0
Cobalt	mg/l	0.19	0.21	0.07	0.07	<0.01	<0.01	
Chromium	mg/l	0.81	0.29	0.7	<0.01	<0.01	<0.01	0.05
Copper	mg/l	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	1.0
Iron	mg/l	0.21	0.38	0.71	0.71	0.19	2.50	0.3
Lead	mg/l	0.98	1.07	0.28	0.53	0.10	0.48	0.05
Magnesium	mg/l	81.4	85.8	0.82	50.8	157	186	
Manganese	mg/l	5.03	2.85	0.27	3.08	<0.01	5.11	0.05
Mercury (ppb)	mg/l	<1	<1	<1	<1	<1	<1	1
Nickel	mg/l	0.25	0.21	0.12	0.1	<0.01	<0.01	
Potassium	mg/l	36.3	101.5	15.4	367.8	28.5	88.1	
Sodium	ug/l	453.6	865.3	373.8	713.1	680	853	
Vanadium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Zinc	mg/l	1.09	0.2	<0.01	0.07	0.05	<0.01	5.0
Ammonia as N	mg/l	<0.1	<0.1	<0.1	1.5	0.13	4.1	
Nitrate as N	mg/l	0.6	0.45	0.2	5.5	<0.10	<0.10	10.0
Chloride as Cl	mg/l	229.8	174.3	311.1	86.4	278	200	250
Sulphate as SO4	mg/l	129	220	320	154	9.6	86	500
PCB	ug/l	-	-	-	<0.05	-	-	

Notes
1) Sampled May, 1991 by Nolan, Davis and Associates
2) Sampled January, 1992 by Nolan, Davis and Associates
3) Canadian Water Quality Guidelines, March 1987

considered to be contaminated. The water sample locations are shown on Figure 3-4.

3.4.3.1 Groundwater Quality - Background

Groundwater samples, recovered from boreholes R1, G10 and G11 as part of the recent ground and surface water sampling program are considered to be background samples uncontaminated by site activity. R1 is located in the area of the proposed disposal site while G10 and G11 are on Stone property near the property line on the west side of the Mill yard. The results of analytical testing performed on the samples from these locations are presented in Table 3-2. Also presented are the analytical test results of a water sample from G5 recovered from a piezometer adjacent to the existing lime sludge pile and away from current ash disposal operations. The background groundwater quality based on the present test results, is slightly acidic, quite hard (high in magnesium and calcium), with silica concentrations close to saturation for crystalline silica. The groundwater has concentrations of a number of elements which exceed the maximum acceptable concentration (MAC) specified for drinking water in the Canadian Water Quality Guidelines (CWQG) as discussed below.

- The concentrations of chromium and lead at R1 and G11 exceed the MAC of 0.05 mg/L.
- The concentrations of iron and manganese, would render the water unpleasant to drink but not harmful.
- The concentrations of cadmium, lead and chromium could exceed MACs.
- Analyses of unfiltered samples in comparison to filtered samples indicate that mercury is bound to soil particles under the groundwater chemistry conditions found in R1, G10 and G11. Though the concentration of mercury is higher in unfiltered than filtered samples, it is still only present at extremely low concentrations.

The test results indicate that G5 sample is uncontaminated groundwater, although the piezometer is situated down gradient, and adjacent to, the lime sludge pile. The water analyzed from G5 has lower concentrations of calcium than found in R1.

In summary, the background water quality at the Stone site show high levels of a number of metals. This however, can be anticipated considering the general high metal content of the soils in the area (Present, 1971).

3.4.3.2 Groundwater Quality - Leachate

Attempts to recover water samples from the two monitoring wells believed to be contaminated by the existing ashfill site, G2 and G3, were unsuccessful as both were blocked above the water levels. The results of chemical analysis of groundwater samples from G2 and G3 during earlier studies (Geocon, 1989) showed highly elevated calcium concentrations as well as elevated concentrations of a number of heavy metals.

Three monitoring wells were recently installed by Nolan Davis in the existing disposal pile at locations down gradient of the sites of previously installed monitoring wells. The location of the new monitoring wells, noted as N1, N2 and N3, are shown on Figure 3-4. The most recently installed monitoring wells will be incorporated within the monitoring program (Section 5) for this site. Water samples were recovered from the three wells plus a seep on the eastern slope of the pile noted as NS-1. The results of analytical testing of water samples from these wells are presented in Table 3-3 along with the results from the analysis of the water seep. It is believed that all four samples are representative of the leachate generated from the existing disposal pile.

The leachate has concentrations of a number of elements which exceed maximum acceptable concentrations specified for drinking water in the Canadian Water Quality Guidelines as discussed below.

* Iron exceeds MAC's specified in CWQG by up to approximately four times.
* Manganese exceeds MACs specified in CWQG by up to 10 times.
* Concentrations of potassium are higher than those found in the background groundwater. No standards are set in CWQG for potassium in drinking water or for water for aquatic life.
* Leachate water is very hard as indicated by the calcium and magnesium

concentrations with hardness up to 500 ppm.

* Chromium concentrations exceed the MACs specified in CWQG but are the same order of magnitude as those detected in background groundwater.
* Lead concentrations exceed the MACs specified in CWQG and are an order of magnitude higher that those detected in background groundwater samples from R1 and G10.
* Cadmium concentrations exceed the MACs specified in CWQG and are an order of magnitude higher than those detected in background groundwater.
* Nickel concentrations are slightly above recommended CWQG concentrations for aquatic life for water of hardness greater than 180 ppm hardness (as $CaCO_3$). No MAC's are recommended for drinking water.
* Concentrations of nitrate, chloride and sulphate are 4-5 times above background concentrations but are still less than the MAC's for drinking water standards.

It should also be noted that mercury was not detected in the four samples from the existing disposal site analyzed.

Compared with background groundwater, the chemistry of the leachate from the existing disposal area has concentrations of calcium, magnesium (resulting in elevated hardness), iron, manganese and potassium that are significantly elevated with concentrations of lead, cadmium and nickel somewhat elevated. The concentrations of chloride, sulphate and nitrate are higher in the leachate than in the background groundwater but do not exceed MAC's specified in CWQG. The leachate seep sample NS-1 has elevated concentrations of potassium sodium and slightly elevated concentrations of calcium, chloride and sulphate.

3.5 SURFACE WATER

3.5.1 Nepisiguit River

Since its construction in 1904, the Bathurst mill has been utilizing water from the Nepisiguit River in its process and releasing wastewater into the river and harbour. Current demands are

approximately 22 million litres per day.

The Nepisiguit River is the fourth largest river in New Brunswick, draining an area of 2340 km^2. It flows from the Nepisiguit Lakes west of Bathurst in an easterly direction for 126 km to Chaleur Bay. The upper reaches of the river flow through a mountainous "U"-shaped valley. The middle section flows through a gorge cut by the river in hilly terrain while the lower reaches flow across the coastal plain to the east. The course of the river is generally controlled by bedrock. Stream gradients decrease from about 2.5 m / 100 m in the upper reaches, to about 0.2 m / 1000 m in the coastal plain (IEC Beak, 1985).

The upstream half of the estuary follows the well delineated course of the river through a deep cut valley with steep slopes. The downstream half of the estuary widens to about 3 km in Bathurst Harbour. The lower 10 km section of the Nepisiguit River is esturial in nature. A distinct underlying salt water wedge extends upriver to the Highway 11 bridge (approximately 2 km upstream of the mill) on low tides. At high tide the salt water edge may extend an additional 1.9 km upstream of the bridge (IEC Beak, 1985).

The Nepisiguit River discharge is highly responsive to rainfall and snowmelt due to the low natural storage capacity (lakes or swamps) in the drainage area. Steep stream bank and thin soil overburden consisting of glacial materials also contribute to sudden discharges. Records since 1921 suggest that the maximum and minimum daily discharges at Great Falls (representing 80% of the drainage basin) to be 530 m^3/s (April 1973) and 2.2 m^3/s (December 1922), respectively.

A sediment survey of Bathurst Harbour and area carried out in 1983 by Environment Canada (Westlake and Gauthier, 1983) found high levels of heavy metals such as cadmium, copper, mercury, lead and zinc. In particular, high metal concentrations were found in the Nepisiguit River adjacent to the existing Stone mill. While the report indicates that many of the metals are from mining activities, it was suggested that the elevated levels of mercury were from the slimicide that was used in the Stone manufacturing operations. The slimicides alluded to are not now being used by Stone and to the present knowledge, have not been used for over 20 years. Furthermore, the leachate tests from the existing disposal site in Table 3-3 show mercury to be below detection levels. Thus the

inference that mercury is originating in the disposal site as highly unlikely.

3.5.2 Water Quality - Nepisiguit River

The water quality of the Nepisiguit River generally is characteristic of undisturbed water sources in this area of the province with respect to conductivity, hardness, colour, turbidity and pH. However, heavy metal concentrations are higher than typical pristine streams. The soils of the Bathurst area have elevated metal contents (Present, 1971) while further upstream of the Stone mill, a highly developed base metal industry has been operating for over 25 years. It is believed that the high mineral content in the drainage basin contributes to the higher than normal metal levels. Similar levels of metals have been found in the neighbouring Tetagouche River and are attributed to the same source (IEC Beak, 1985).

A summary of the historical water quality of the Nepisiguit, Tetagouche and Little Rivers prepared by IEC Beak is shown on Table 3-4.

3.5.3 Bathurst Harbour

The Nepisiguit River empties in Bathurst Harbour which also receives drainage from three smaller river systems; the Tetagouche River, Little River and Middle River. Bathurst Harbour has a total surface area of approximately 15 km^2 and a mean tidal range of 1.6 m (maximum 2 m). The harbour is generally quite shallow and prone to rapid silt buildup. As a result, there have been several dredging operations to deepen the main channel. Spoil material, mostly soft mud and sand, was deposited in the harbour adjacent to the channel and presently forms low islands (Pearce and Stewart, 1985).

The harbour is almost closed at its mouth by sand bars extending from Caron Point and Youghall Point, a distance of approximately 300 m. Although Bathurst Harbour may appear to be practically isolated from the waters of Chaleur Bay due to its constricted mouth, the harbour is strongly influenced by tidal action. During a 2 m tidal range, approximately 26 x 10^6 m^3 of salt water passes through this gap during a six hour period. It is important to note that the total average

TABLE 3-4
HISTORICAL SURFACE WATER QUALITY
BATHURST AREA

Parameter	Units	Nepisquit River at Pabineau Falls (1969-73)		Tetagouche R. Near W. Bathurst (1970-77)		Little R., 6.4 km SW of Bathurst (1966-77)	
		M	R	M	R	M	R
Specific Conductance	USIE/cm	44	10	109	26	1416	1138
Turbidity	JTU	0.4	0.3	1.6	2	2.2	3.4
Colour	Rel. Units	35	21	14	11	40	24
pH *	mg/L	6.8	21	7.5	1.2	3.2	6.2
Alkalinity	mg/L	-	-	45.7	11.6	1	11
TDS	mg/L	-	-	58	13	732	596
Hardness	mg/L	16.2	3.5	52	12.7	267	244
K	mg/L	-	-	0.5	0.2	5.9	16.3
Na	mg/L	-	-	21	0.5	83.6	80.4
Ca	mg/L	4.76	1.16	16.4	4	69.8	65.8
Mg	mg/L	1	0.2	2.6	0.6	6.4	6.7
Cl	mg/L	2.2	0.6	1.7	0.6	14.6	31.3
SO4	mg/L	-	-	7.5	2.1	562	453
O2	mg/L	-	-	12.1	1.8	9.7	3.2
NO2+NO3	mg/L	-	-	0.132	0.148	0.135	0.176
NH3	mg/L	-	-	0.095	0.078	0.49	0.281
TKN	mg/L	-	-	0.5		0.5	0.1
PO4	mg/L	-	-	0.016	0.022	0.026	0.026
TP	mg/L	-	-	0.015	0.023	0.034	0.035
TIC	mg/L	-	-	9.6	2.3	0.6	0.2
TOC	mg/L	-	-	5	2.9	8.3	3.3
Fe	mg/L	0.284	0.115	0.114	0.079	14.6	15.9
Ni	mg/L	-	-	0.023	0.01	0.015	0.009
Cu	mg/L	0.021	0.031	0.015	0.03	0.041	0.093
Zn	mg/L	0.108	0.097	0.02	0.026	1.6	10.4
Hg	mg/L	-	-	0.13	0.15	0.07	0.04
Pb	mg/L	0.009	0.019	0.003	0.004	0.5	2.06

Notes: 1) all records are summarized as average and (standard deviation) over period of record
* mean (observed range)
2) data supplied by Environment Canada, 1961-1977 summaries
M - Mean R - Observed Range

flows of the four main tributaries of the harbour have only a minor influence on the net water balance of the harbour. It has been determined that on an average tide (0.65 to 1.71 m) the total freshwater inflows to the harbour account for only 8 percent of the total outflow. Similarly, the tributary flows offset a percent of the incoming sea water on rising tides (IEC Beak, 1985).

3.6 BIOLOGICAL RESOURCES

3.6.1 Fisheries Resources

A variety of fish species inhabit the Nepisiguit River system and Bathurst Harbour. The following summarizes the fish species whose lives are closely tied to the section of the river adjacent to the proposed development.

Although it is believed that striped bass do not spawn in the Nepisiguit River system, they do enter the harbour from Chaleur Bay during the spring. Most of the sport fishing activity is conducted at the mouth of the harbour but some years striped bass may also be taken at the causeway across the inner harbour. Striped bass populations are very cyclical and the size of the sport fishery varies from year to year depending on the abundance of bass (Doucet, 1991). Current angling activity is limited due to low bass numbers. The reason for low bass numbers is not well known. However it is not a local phenomenon since it has been documented throughout its range along the Atlantic coast.

Rainbow smelt are an anadromous species (i.e. living in salt water but spawning in freshwater) that spawn in the lower reaches of many of the tributaries of Bathurst Harbour. Smelt likely do not spawn in the Nepisiguit River in the vicinity of the proposed development due to the presence of the underlying wedge of saltwater and the absence of clean rock substrate (IEC Beak, 1984) necessary for the attachment of the adhesive eggs (Scott and Crossman, 1973). Smelt enter Bathurst Harbour from Chaleur Bay during the fall and winter months in preparation for spring spawning. Smelt support a significant winter fishery with commercial fishermen operating 12 nets (five licences) in the channels among the islands in the harbour. A increasing number of sport fishermen are ice fishing for smelt in the harbour. During the winter of 1990 approximately 50-60 ice fishing huts were present on the ice in the harbour concentrated near West Bathurst. A number

of huts were also located near the marina wharf at Youghall, just inside the harbour mouth. During the smelt spawning migration in May, a dipnet fishery occurs for this species in the Lower Nepisiguit River among the islands upstream of the Highway 11 bridge (Doucet, 1991).

Sea trout are brook trout that over-winter in the estuaries of many Maritime rivers and usually acquire a more silvery appearance and attain a larger size than trout restricted to freshwater. In the Nepisiguit River, a number of anglers fish each spring in the lower 4-5 km of the river for sea trout (Doucet, 1991). The fishery supports considerable angling effort lasting 3-4 weeks each spring usually in the month of May. Although brook trout may live and feed in the Nepisiguit estuary in the vicinity of the proposed development, all spawning and juvenile rearing occurs well upstream of the estuary in cold, clear tributaries. Brook trout is the most popular species of sport fish in the province.

Atlantic salmon support an extremely important sport fishery in the Nepisiguit River. Until recently Nepisiguit salmon stocks were declining as a result of over fishing (both legal and illegal activities) and habitat destruction from a number of sources. However, in response to a large amount of government and public effort, salmon populations have rebounded. Presently, the Nepisiguit River supports a healthy salmon population and a large sport fishery. The section of the Nepisiguit River in the vicinity of the proposed development serves as a migration corridor through which mature salmon ascend to spawn in upriver areas, and through which salmon smolts pass on their way downstream to sea where they grow and mature. There is no spawning or juvenile rearing habitat for salmon in the vicinity of the proposed development.

Shellfish (clams) inhabit the mud flats of Bathurst Harbour. However, as with most harbours and sea-side communities, the shellfish are contaminated with pollutants (fecal coliforms and metals) and are not safe for human consumption. Currently, the outer limit of the zone of contamination is at the mouth of the harbour. However, it has been proposed to extend the zone of contamination outside the harbour to include those beaches between Peters River and Salmon Beach (1991). A limited number of permits are supplied each year to harvest clams in the harbour for use as bait for sport fishing for cod in Chaleur Bay (Doucet, 1991).

Prior to 1975 there was a commercial fishery in the harbour for eels. This fishery was concentrated at the mouth of the Tetagouche River as well as in the channels among the islands in the harbour. An unexplained decline in eel populations was the apparent cause of the termination of this fishery (Doucet, 1991).

In addition to the above, commercial fisheries occur outside the harbour in the waters of Nepisiguit Bay for lobster, herring and mackerel. A sport fishery for mackerel also occurs in these waters (Doucet, 1991).

3.6.2 Benthic Invertebrates

Benthic invertebrates were sampled in the Nepisiguit River by IEC Beak during the course of environmental investigations in 1981 and 1984. The investigations found dense, diverse, invertebrate populations in the river upstream of the mill, near the opposite shore adjacent to the mill and further downstream of the mill. The organisms found at each locations belonged to the Polychaeta, and Bivalvia taxonomic groups. The Crustacea taxonomic group was also found upstream and on the opposite shore while Oligochaete was found downstream. At sampling stations immediately adjacent to the mill no organisms were found.

It is important to note that the most recent invertebrate samples are from 1984 and the existing ash pile was begun in 1986. Therefore, the existing benthic invertebrate sample results do not reflect any influence of dust, runoff or leachate from ash. The 1984 survey will be updated in 1992 prior to development of the new ash disposal site to provide additional baseline data.

3.6.3 Wildlife

During a March 22, 1991 site visit, several species of birds were observed on the site. These included crows, black-capped chickadee, evening grosbeak, and American goldfinch. Signs indicating the presence of pileate woodpecker and ruffed grouse were also noted at that time. It is likely that any species of bird native to this area and that occupies forest-field-cutover habitat might be found on the site during the summer months. A site visit of June 14, 1991 found additional common

summer resident bird species. The most interesting species was a merlin (pigeon hawk) that appeared to be nesting in trees at the northwest corner of the site. These trees will form part of the buffer zone. However, no evidence was found in either site visit to suggest this site may contain critical habitat for any species of bird.

With respect to mammals, red squirrel was the only mammal spotted during the March 22 site visit. However, possible coyote and pine martin tracks were noted at that time. It should be noted that tracks, or other signs of deer and moose were not found. Although this area may be visited by deer and moose it appears that it is not used as a wintering yard for these species. It seems likely that most mammals native to this area of the province (Dilworth, 1984) may frequent this site. However, no evidence was found to indicate that the site contains "critical" habitat for any species. Discussions with both Nepisiguit Nature Club and Stone personnel confirm that the site has no unusual attraction for wildlife that would make it more important than nearby surrounding farms.

3.7 TERRESTRIAL ECOSYSTEM

The proposed disposal site has a terrain that is gently sloping downward in a general easterly direction. Adjacent to the river there is a steep slope of 15-20 m to the river. With the exception of a 50 m wide hay field bordering on Stone's southern property line, the site is principally forested. Within this forested area, however, are several small cut over areas.

The site has a predominately mixed forest type of cover containing mature hardwood and softwood species. The dominant tree species include white birch, white pine, white spruce, trembling aspen, red maple and jack pine. The jack pine occurs in nearly pure stands on the western side of the site. Scattered individuals of yellow birch, beech and red pine were also noted. It appears that balsam fir once was a dominant species based upon the number of dead (likely budworm killed) trees on the site. Today most of the balsam fir occurs as young trees in the understorey. Various intolerant hardwoods also occur in the understorey in openings in the forest. All of the tree species mentioned above are characteristic of the Eastern Lowlands forests of the Acadian Forest Region which includes the site of the proposed development (Rowe, 1972).

On June 14, 1991 a survey of plants native to the site was conducted by H. Hinds and R. Currie. The results of this survey is presented in Appendix IV. In summary, a total of 186 species of plants were noted. Although some species are more abundant than others, none is considered rare to the province.

3.8 ECOLOGICAL RESERVES AND CRITICAL NATURAL AREAS

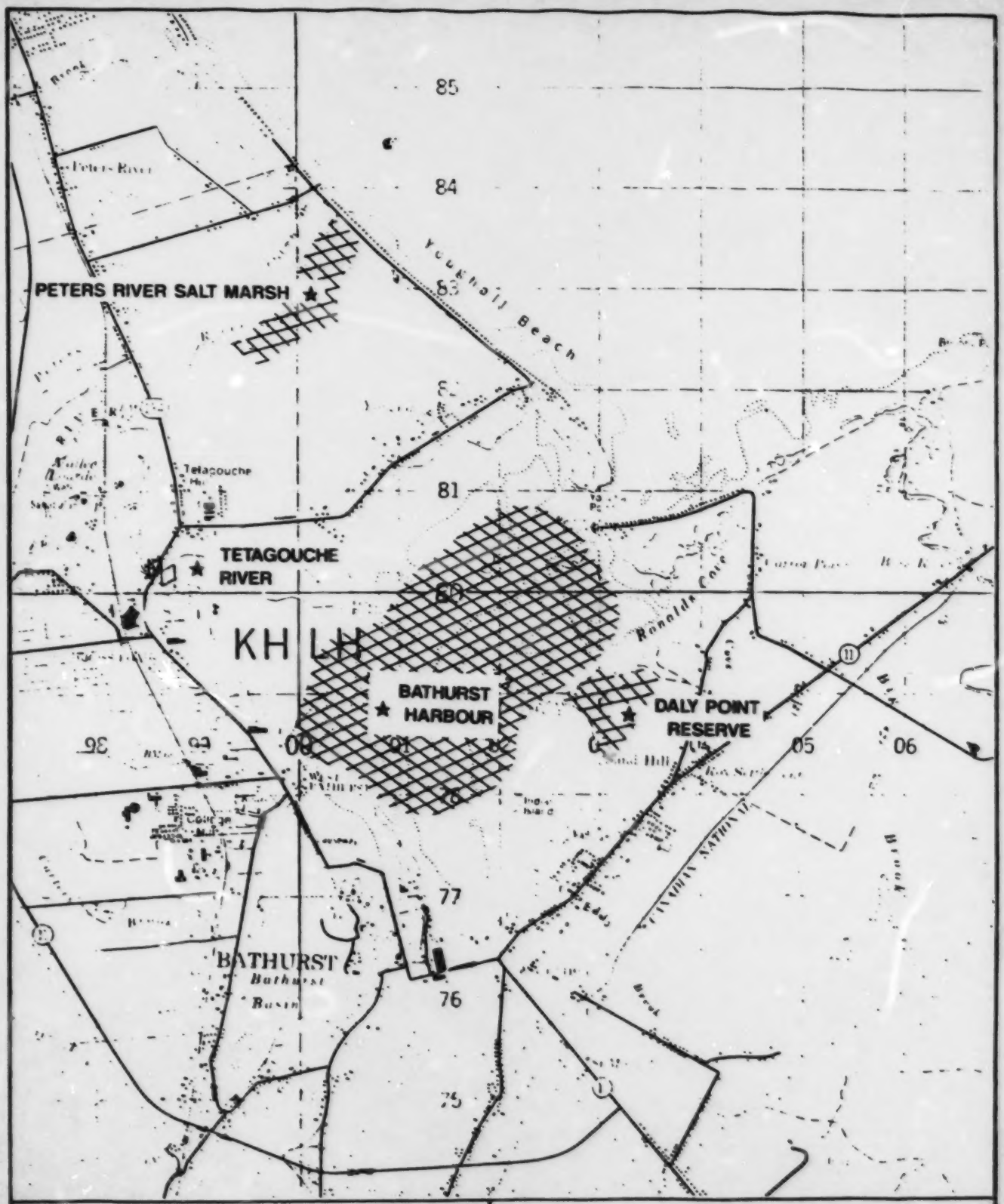
Several areas in the vicinity of the proposed development have been identified as having ecological significance. The location of these areas is shown on Figure 3-5.

Bathurst Harbour has been designated as a "critical natural area" (Dionne et al. 1988) when in 1965 it was discovered that ring-billed gulls were nesting on the low artificial islands in the harbour. In the years following, these islands were the only known nesting site in the province for this species. More recently several additional nesting colonies have been discovered at other sites in the northern part of the province. Herring gulls, great black-backed gulls, common terns, red-breasted mergansers and occasionally spotted sandpipers also nest on these islands (Pearce and Stewart, 1985).

Peters River Salt Marsh, just north of Youghall, has been identified as a proposed ecological reserve (Wein, 1975) as well as a critical natural area (Dionne et al. 1988). The area has been selected because it represents a classic salt marsh ecosystem with unique floral characteristics such as cord-grass, Spartina patens, sea-milkwort and arrow grass. Also, this marsh is home to two species of butterflies, the sale-marsh copper and Inornate Ringlet, that are endemic to the Bathurst area.

A small area at the mouth of the Tetagouche River has been identified as a critical natural area (Dionne et al. 1988). A section of riverbank at this location contains a rare form of aster, Aster subulatus Michx. var. obtusifolius Fern. This variety is endemic to this area.

The Daly Point Reserve has recently been developed on the eastern side of Bathurst Harbour. One hundred acres of saltmarsh and associated upland habitat have been cooperatively developed by



NOLAN, DAVIS & ASSOCIATES

FIGURE 3-5

ECOLOGICAL RESERVES AND CRITICAL NATURAL AREAS

Brunswick Mining and Smelting Corp. Ltd. and DNRE as a nature interpretation centre for local ecosystems (Penak, 1991).

3.9 SOCIOECONOMIC SETTING

3.9.1 Demography

The project is located in the City of Bathurst in the Province of New Brunswick. The 1985 Census data indicate the population of Bathurst to be 14, 680. The current work force at Stone is approximately 1000, many of whom are residents of Bathurst.

More specifically, the project is located in South Bathurst which has population of 1284. South Bathurst is predominately a residential neighbourhood with many of the homes being single detached dwellings. South Bathurst is an older, well established, community with most of the homes being over 40 years old.

Most of the residences in South Bathurst now have full city services including water. However it has come to our attention that seven residences in the area still use deep wells for their water supply. These residences and their locations are:

Gerald Glazier	Church Street
Emanuel Landry	Church Street
Ernest Chamberlain	Church Street
Gerald Gionet	Lavigne Street
Ms. Alfred Glazier	Church Street
Ms. Edmund Lavigne	Lavigne St.
St. Theresa's Rectory	St. Theresa's Lane

The project also impacts to a certain extent on the community of East Bathurst located directly across the Nepisiguit River from the site. The population of East Bathurst is 3246. Most of the residences in East Bathurst are single detached dwellings generally over 40 years old. However unlike the residents of South Bathurst both the existing and new disposal sites are in their area of view.

The Chaleur Industrial Park is also located in East Bathurst.

The existing disposal site is zoned for heavy industrial usage. However, the new disposal site is currently zoned for rural usage. Stone has approached Bathurst Municipal Officials regarding the rezoning of the site. The required zoning is currently not in place.

3.9.2 Siting Requirements

At present, provincial guidelines are not available with respect to an ash disposal site. Provincial siting guidelines do exist for Municipal Solid Waste (MSW) landfills and these have been applied to the assessment of this site.

The proposed new ash disposal site meets or exceeds the following current NBDOE siting requirements from a socioeconomic point of view for the siting of a MSW disposal facility:

		NBDOE Setback Guidelines	Met by Bathurst Site
1.	Private residence, proposed or existing residential development	500 m	Yes
2.	School, hospital or other health care facility	500 m	Yes
3.	Commercial or industrial establishment	300 m	Yes
4.	Land designated as residential commercial or mixed	150 m	Yes
5.	Arterial or collector highway	150 m	Yes
6.	Public Park	300 m	Yes
7.	Airport	8000 m	Yes

The site however, does not meet the current NBDOE siting guidelines for the following:

MSW Siting Guidelines	Stone Site
Landfill must not be within 100m of a property line	Site 50 m from south property line
Landfill must not be within 300m of a major lake or stream	Site 100 m from Nepisiguit River
Minimum area for a MSW landfill is 40 ha	Total area - 15 ha.

When considering the siting requirements, it must be kept in perspective that the new ash disposal site is for a singular waste (ash) as opposed to a MSW. The impacts from a singular waste are much more predictable and do not involve public nuisance or health factors such as the attraction of birds and rodents, odours etc. Furthermore, mitigation measures can be better engineered for this type of disposal site. Thus it is felt that the property line and area requirement which apply for a

MSW can be relaxed for this project. The 50 metres between landfill and property line will be a full tree buffer. The adjacent landowner has been advised by Stone of the project. With regard to the land requirements, the waste pile with a projected life of twenty years will still envelope less than one third of the total area.

Because the site is within 100m of the Nepisiguit River, the NBDOE ATC/O will require additional design features to provide an increased factor of safety against environmental impact to the river. Stone in a letter of May 15, 1991 to NBDOE are on record stating that they will include additional design features in the new site to mitigate the impacts of this siting. These features include:

(1) Improve the leachate collection system by installing additional piping under the two cells closest to the river, thus removing leachate immediately, reducing contact time with the clay liner.

(2) Special attention will be directed towards the design of the liner for the two cells closest to the river, i.e. thicker clay lining.

(3) As part of the monitoring program, a contingency plan will be developed in the unlikely event that an environmental problem occurs.

(4) An increased monitoring program would be developed to take into consideration the close proximity to the river.

3.9.3 Public Attitudes

An extensive public consultation program (Section 6.0) has identified the following issues as being of public concern:

(i) Dust control - The public has concerns as to how Stone will control the ash

dusting problem from both the existing site and the new site.

(ii) Groundwater contamination - The public is concerned that the quality of groundwater will be impacted by the project.

(iii) Aquatic environment - Concern was expressed regarding potential impacts of the project on the adjacent Nepisiguit River.

(iv) Waste characterization - The public was concerned as to whether any hazardous materials are buried in the existing disposal pile and how they might impact the environment.

The participants in the public consultation program generally had no objections to the project once the proposed development and its specific environmental controls were explained.

3.10 OVERVIEW OF EXISTING ENVIRONMENT

The existing disposal site, which has been in use for over 40 years, is located on Stone property zoned as heavy industrial. The new ash disposal site will be located to the immediate south of this site on land which is mostly wooded with growth common to the area. No rare or endangered plants or animals are found at the new site (Hines, 1991).

Both existing and proposed disposal sites are located in an area which is considered to have hydrogeologic conditions suited for the type of development proposed. The deep deposits of silty clay and glacial till provide both a natural attenuation system for leachate plus a protective barrier for the underlying groundwater resources.

4.0 IMPACT ASSESSMENT AND MITIGATION

4.1 METHODOLOGICAL APPROACH

The potential impacts to both the biophysical and socioeconomic setting have been predicted based on a review of relevant literature, consultation with experts and professional judgement. The EIA predictions are based on a combination of objective and subjective evaluation with the objective (measurable) analysis used where possible. However, under certain circumstances, the predictions depend in part on professional judgement, speculation or experience.

The preparation of this section of the EIA Report involved the interaction of the "project description" and "existing environment" texts so as to identify potential impacts. The impact predictions reflect the degree of refinement in the Study Boundaries and project design at the time of the EIA Report preparation.

The impact assessment of elements in both biophysical and socioeconomic settings has generally followed the following approach.

Potential Interaction/Impact - A description of the degree to which each project activity will interact with the Valued Environment Component(s) with a summary of the major concerns regarding the potential impacts of each project activity.

Existing Knowledge - A summary of the current level of knowledge upon which the impact predication is based

Impact Prediction - A description of potential impacts of the project activity.

The impact prediction fall into four categories, namely negligible, minor, moderate and major. Negligible impacts are defined as none or insignificant, minor as measurable but can be mitigated, moderate as high impact but can be partially mitigated and major as a non mitigable

significant impact that will be detrimental to the environment.

A discussion of the impacts for each project activity is provided below. Impacts which have been determined to be non-significant have also been identified.

4.2 CLOSURE OF THE EXISTING SITE

4.2.1 Construction

The closure of the existing site will involve two identifiable activities , namely the construction phase and a long term maintenance. The construction activities associated with the closure have been ongoing in 1991. Closure of the existing site is expected to be about 75% complete by the end of this year. Closure will be completed when the new disposal site is available.

The Valued Environmental Components which construction activities will directly impact include groundwater quality, surface water quality, aquatic life, human health and safety, and community issues such as aesthetics and dust control. The closure of these activities will have no impact on the other VEC's or VSC's identified in Section 3.1.2.

4.2.1.1 Surface Water Quality

The principal concern of the construction activities is erosion and siltation from site runoff. The excavation and shaping of the existing pile has been completed on the top and slopes adjacent to the Nepisiguit River. A soil cover placed on the stabilized slopes and hydroseeded in September of this year.

Ash is presently being placed along the western face of the pile with the final cover placed once the new site is developed. Runoff from this area is presently being collected in temporary ditches and the recently installed storm sewer and discharging to the river. This runoff will be retained in the sedimentation pond which will be the first structure to be constructed. This impact of runoff from the discharge of sediment runoff once the sedimentation pond is in place is minor.

4.2.1.2 Aquatic Life

Runoff from the site eventually discharges to the Nepisiguit River. The water quality of the runoff will be highly variable depending on a number of factors including the type of waste over which the water flows. Surface runoff which flows over the biomass ash at the existing disposal site is by NBDOE definition considered leachate. The runoff can be expected to have a high pH and elevated levels of some heavy metals which may be toxic to aquatic life.

Proper construction practices, principally through ditching and silt traps, will control the flow of runoff which will be directed to the sedimentation pond. The ditches and silt traps will be designed for the 1 in 50 year 6 hour rainfall event. Retention in this pond will reduce the sediment loadings from the ash or other waste in the runoff to below NBDOE allowable limits (25 mg/L).

4.2.1.3 Community Issues

The close proximity of the existing disposal site to residential areas of East and South Bathurst makes the community issues relating to aesthetics, noise, litter and dust control a major concern. Through the public consultation process the study team has identified dust control as the key community issue relating to the existing disposal site.

Since the mill started to burn hog fuel in 1986, there has been a public concern about the ash dusting problem. The fine grained nature of the ash makes it highly susceptible, when dry, to transport by wind. As indicated in Section 3.2.3 the prevailing wind direction of the area is to the west with southeast winds also having a significant impact. However, recent construction activities have mitigated most of the problems with dusting.

The impact from dust on the community from the placement of the cover over the western face of the pile is predicted to be minor. Mitigative dust control measures such as wetting of the fine grained soils and avoidance of earth moving activity during times of high winds will be applied if the conditions warrant.

4.2.1.4 Human Health and Safety

Prior to 1991 the eastern slope of the disposal pile, which was placed on the crest of the river bank and sloped upward at a 1H:1V slope 12 to 15 m above the original ground was considered unstable. The reshaped slope, which slopes upward at 3H:1V with the toe 6m from the crest of the river bank, has an improved factor of safety against failure and hence stability over the long term. The impact of the construction on safety is therefore positive.

4.2.2 Maintenance of Existing Disposal Site

4.2.2.1 Groundwater Quality

One of the foremost public concerns expressed to the study team during the public consultation process was the impact of the existing disposal site on groundwater both now and in the future. There is some question as to the type of waste material buried within the pile, particularly as to whether hazardous wastes are involved. The type of waste buried will in turn be reflected in the chemistry of the leachate from the pile which eventually becomes incorporated into the regional groundwater flow.

As noted in Section 2.2.1 over 25% of the existing pile was moved without any indication of hazardous materials within the pile. Furthermore, recent chemical analyses on water samples recovered from monitoring wells put down through the disposal site plus the seep on the river slope (Section 3.4.3.2) show elevated levels of metals as well as potassium and sodium. However, there were no traces of either mercury or PCBs found in the water samples tested. The results of this testing, plus the observations during excavation, provide some confidence in the conclusion that there is unlikely to be any hazardous material in the pile.

The leachate presently generated by the existing pile consists of surface runoff plus water seeping through the pile into the underlying groundwater. The volume of leachate presently being generated is very difficult to predict. The worst case situation assumes that all precipitation falling on the landfill generates leachate. Under this scenario leachate would be generated at a annual rate of over 20,000 m^3. This is highly unlikely since, even under the present conditions when the disposal

site is relatively absorbent, much of the precipitation falling is lost to evapotranspiration.

Over the long term, the placement of the clay cap with a vegetated cover will greatly reduce the volume of leachate produced by the existing pile. It is assumed that the period before vegetation is fully established will be two years. Assuming 20% of the precipitation that falls on the disposal site per year which results in a basal leachate, generation is predicted to be 4000 m^3 annually. The generation rate of the site will gradually decline from about 4000 m^3 annually to a negligible amount once an effective cover has been established (Rowe, 1988).

The disposal site cover is 75-80% complete with ash currently being placed along the western face of the pile. As noted in Section 4.2.1.1 surface runoff from this area is currently being collected by ditches and storm sewer.

There will be a certain amount of leachate attenuation beneath the disposal site as a result of the adsorptive properties of the underlying formations. In general the base of the existing disposal site is above the water table, though sporadic incursions of the water table into the ashfill do occur. The most likely time for water table incursion into the existing site is during spring runoff, partly as a result of the natural water table rising and partly as a result of mounding of the water table under the site because of enhanced recharge. Once the disposal site is covered and graded the latter effect will be reduced considerably. Drainage under the old site is quite good which will ensure that mounding under the site will be limited.

The MODFLOW computer program was used to predict the rate of movement through the HU1 unit which available information indicates to be highly permeable and hence the pathway of least resistance that leachate would follow. In the event that groundwater quality is impaired by leachate, available information indicates that the contaminant plume will migrate in an eastward direction. The rate of movement is difficult to predict but using MODFLOW, with the static water levels measured from piezometers across the site, and assuming the sand and gravel to have a permeability of 1 x 10^{-2} cm/sec, it is estimat[illegible] plume would migrate laterally eastward through the HU-1 unit at an annual rate of between 50-75 m. Because of the large difference in hydraulic conductivity between sand and gravel and underlying clayey silt to silty clay, the lateral movement

will predominate. Eventually the leachate will exit along the river bank. The volume of leachate exiting is predicted to be minor and hence no special mitigative measures are proposed. In the event flow rates increase significantly, collection ditches may be required.

The placement of the impermeable clay cap over the existing disposal pile will have a major positive impact on groundwater quality by eventually reducing the volume of leachate entering the ground water from the pile to virtually zero levels. A comprehensive monitoring program (Section 5.0) will allow the quality of the groundwater and any future impacts to be assessed on an ongoing basis.

4.2.2.2 Community Issues

The final cover to be placed will eliminate the dusting problem from materials within the pile. As noted previously, approval has been given by NBDOE for partial placement of the final cover, primarily along the eastern slope. This partial placement will controls the dusting problems from most of the disposal site. The final cover will be placed over the remainder of the pile once approval has been given.

The final 3H:1V slope of the pile will be hydroseeded with a self maintaining vegetative cover. In September, the eastern slope and top of the pile were hydroseeded. The vegetated slope will be a great improvement, aesthetically from the previous situation.

In terms of the community issues the proposed closure plan will have a very significant positive impact. Not only will the final vegetated cover eliminate dusting problems from this site, it will also provide a significant improvement on the current landscape appearance particularly when viewed from East Bathurst.

4.3 NEW ASH DISPOSAL SITE

The new ash disposal site will involve three identifiable activities, namely construction, operation, and maintenance after closure. The following sections discuss the Valued Environment

Components which the new ash disposal site will impact.

4.3.1 Construction of the New Site

The disposal site will be constructed in six phases on a cell by cell basis. It is the intention of Stone to fill one cell before the next cell is developed. Construction activity will be of a short duration, generally less than three months for the construction of each cell. Construction will not be carried out during the winter months. The construction of each additional cell will involve clearing and grubbing of the area of the new cell plus extension of the access road.

The construction phase of the new ash disposal site will be carried out in a sequenced construction schedule. The first task in the development will involve the construction of the sedimentation pond. The sedimentation pond will be completed to a point where it can contain surface runoff from the construction site before the perimeter French drains are installed around the periphery of the new site for dewatering.

4.3.1.1 Surface Water Quality

The initial task associated with the construction is clearing and grubbing. The clearing and grubbing may result in erosion and elevated levels of sediment in surface runoff during times of precipitation, particularly during major rain storms. The runoff will ultimately discharge to the Nepisiguit River. To mitigate the impact of surface runoff, the contractor's first task will be construction of the sedimentation pond. Clearing and grubbing will be limited to the area of this pond until the pond is completed to a point where it can contain runoff from the construction site. Once in place, all site ditching as well as the perimeter French drains will be directed to this pond so that any surface runoff will be collected and retained prior to discharge.

Proper engineering and construction practices, such as silt traps and holding ponds, will reduce and control the release of sediment laden water to the standards established by NBDOE. The impact from construction activities on the surface water quality is therefore predicted to be minor.

4.3.1.2 Vegetation

The construction of the new ash disposal site will ultimately remove over 5 ha of existing wooded area. The forest type is predominately a mixture of hardwood and softwood species characteristic of the area. There are no rare or endangered species at the site.

The development of the new disposal site will also involve the planting and maintenance of a 50 metre wide tree buffer on the east, south and west sides of the site. Through selective cutting and proper silviculture management, the growth of current vegetation in the buffer area will be enhanced.

The impact from construction activities will not have any impact on vegetation from a regional viewpoint.

4.3.1.3 Community Issues

The community concerns related to the construction of the new ash disposal site, will be the dust and noise from the site.

Should dusting become a serious problem during the summer months special mitigative measures will be employed. The most common approach will be to wet down all areas from which the dust is blowing. However, due to the temporary nature of the construction period any impact from the noise and dust will be temporary in nature. No long term impacts are predicted.

4.3.2 Operation of the New Site

4.3.2.1 Groundwater Quality

Chemical testing of leachate from the biomass ash has shown it to contain elevated levels of certain metals and a high pH. This leachate, should it seep into the underlying groundwater will have an impact on the quality of groundwater.

The new ash disposal site will be designed to meet the NBDOE requirements for a Municipal Solid Waste landfill site. To protect the groundwater of the area a compacted soil liner and a leachate collection system will be provided to collect and contain any leachate generated. The leachate will be treated if required prior to discharge. The new ash disposal site will be designed with an internal drainage system which will collect most of the leachate and direct it to the holding pond. Only a very minor fraction of the total leachate generated will penetrate the disposal site liner once a cell is completed.

The leachate generated within a cell could potentially penetrate the liner by two means, advection and diffusion. Advection is the bulk movement of dissolved matter in the groundwater stream and is considered to be the dominant transport mechanism in soils such as gravel which has a high hydraulic conductivity. Diffusion is a means of contaminant transport across barriers of low permeability such as the soil liner. The movement of contaminants across a liner will be dominated by diffusion at a permeability of 10^{-8} cm/sec or less.

The infiltration rate into the underlying liner is highly sensitive to the spacing of leachate collection drains. The greater the drain spacings, the greater the hydraulic head in ash, which will tend to force leachate through the liner thus increasing the volume of leachate escaping to the groundwater. The final design of the leachate collection system will be to NBDOE requirements. For the two cells developed closest to the river (100m), additional leachate collection piping will be provided so that the leachate penetrating the liner will be a minimum.

The volume of leachate which could penetrate the engineered liner of a cell in any year is difficult to predict due to the variations in the liner permeability, leachate head, etc. However, based on the precipitation records from the area, it is conservatively estimated that the maximum volume of leachate which will penetrate the liner may be up to 300 m^3 annually. With the high adsorptive ability of the underlying formations, and the liner itself, this amount of leachate will only affect the groundwater in the immediate down gradient vicinity of the proposed ash disposal site and will have little impact on groundwater outside of the property boundary. As illustrated in Figure 3-2, the new site is underlain by 8-10 m of silty clay and glacial till, of which collectively form a natural soil liner having a permeability in the order of 10^{-7} to 10^{-8} cm/sec.

The drinking water supplies, particularly from the wells in South Bathurst, are drawn from the deep sedimentary bedrock formations. The ash disposal site design and the presence of up to 10 metres of undisturbed silty clay and glacial till under the new disposal site will protect the water quality of these wells. Furthermore, any seepage from the disposal site will flow towards the Nepisiguit River to the east rather than westward.

The infiltration of ash leachate in sufficient quantity and with significantly high levels of contaminants could potentially alter the water quality of the groundwater in the area. However, considering the hydrogeologic setting, and the engineering design and construction quality control requirements, it is predicted that the new ash disposal site will have a negligible impact on the groundwater quality in general and will have no impact on the quality of groundwater recovered from the wells in South Bathurst.

4.3.2.2 Surface Water Quality

The surface runoff from the new site outside of the operating cells will be collected and directed to the new sedimentation pond. There will be no leachate collected in the sedimentation pond. The suspended solid concentration of the water will be reduced in this pond to the standards established by NBDOE as defined in the ATC/O prior to discharge.

Leachate collection will be ongoing during the operation of the new landfill. However, there is a potential for some leachate (up to 300 m^3 annually) to penetrate the liner and eventually reach the surface water. Given the low permeability of liner and underling clay and till formations, and the high absorptive ability of the underlying formations, the operation of the ash disposal site will have a negligible impact on the surface water quality.

4.3.2.3 Community Issues

The new ash disposal site will be operated in a safe and environmentally acceptable manner in keeping with the Environment Policies of Stone. Foremost among the concerns of Stone will be dust control. As noted in Section 2.4.3 a number of mitigative procedures are proposed to minimize the impact of dust on the community including wetting of the ash, placing protective soil covers, and final capping and seeding of the site.

To isolate the site, the new ash disposal site will be provided with a tree buffer approximately 50 metres in width on the east, south and west boundaries. The new buffer is presently not in place. The tree types will be selected for this buffer so as to provide a full year round shield. The height of the new landfill will be limited to about 10 metres above the existing ground which will keep it below the top of mature tree growth.

The limited use of the site, coupled with the tree buffer will reduce noise to zero, thus noise is a negligible impact issue. The problems of odour, birds, rodents and litter normally associated with a MSW site do not apply because of the nature of the waste.

The operation of the new ash disposal site, will have a negligible impact on community issues. The special dust control measures proposed will mitigate this problem while the tree buffer will mitigate impacts from noise and improve site aesthetics.

4.3.2.4 Transportation

The biomass ash generated at the Stone mill will be transported to the new landfill over a new all-weather road constructed entirely on Stone property. The transportation of ash to alternative sites off the Stone property would increase the risk of highway accidents involving other vehicles or pedestrians along the route used to transport the waste. There is also an increased risk of ash being spilled in transport. In the event that a spill occurs on Stone property the resources of Stone can be employed to efficiently and effectively clean up the problem.

The proposed operation, which requires the ash to be transported entirely on Stone property in specially equipped trucks, will have no impact on the transportation network or community in the Bathurst area.

4.3.2.5 Land Use and Property Value

The proposed ash disposal site is currently zoned for rural/residential development (R-7) but will be rezoned for industrial usage prior to site development. The Planning Department of the City of Bathurst do not feel that the proposed ash disposal site will impact on long term development within the city (Buffard, 1992).

The site is located in an area of heavy industrial development and the current property values reflect this. Recent studies (Zeiss, 1988) have shown that waste facilities have inconsistent or insignificant effects on residential property values. Thus the development of a new ash disposal site is predicted to have no impact on property values in the surrounding area.

4.3.3 Closure and Maintenance

The closure of the ash disposal site will be carried out on an annual basis. As one area of the cell reaches its final design elevation, the final impermeable cover will be placed and vegetated. The final surface will be shaped to minimize water percolation through the completed disposal area.

4.3.3.1 Surface Water Quality

The closure of the site, involving the placement of the final cover may result in sediment laden runoff during periods of heavy precipitation. However, proper construction procedures, involving ditches and silt traps grading to the sedimentation pond as outlined in Section 4.2.2.1 will limit discharge to the river.

After the vegetation cover has rooted on the completed slope, problems with erosion and surface runoff will be eliminated.

The closure of the ash disposal site will have no significant impact on the surface water quality.

4.3.3.2 Groundwater Quality

The placement of the impermeable cover over the new disposal site will have the same impact as placement of the cover on the existing disposal site, namely minimizing infiltration of precipitation thereby minimizing the production of leachate. Leachate will continue to be generated at a decreasing rate as steady state conditions develop. Any leachate generated after closure will continue to be collected and treated in the approved manner.

The closure of the new ash disposal site will have no potential impact on groundwater quality.

4.3.3.3 Vegetation

The site will be seeded with a self-sustaining vegetative cover as the final cover is placed. The grassed area may become habitat to several bird species as well as a grazing area for other animals.

The closure of the site will have a positive impact on vegetation.

4.4 NON-IMPACTED VALUED ENVIRONMENTAL COMPONENTS

Closure of the existing site and the construction, operation and closure of the new ash disposal site will have no impact on a number of the VECs and VSCs identified in the Guidelines. Following is a discussion on each of these components and the rationale for identification as no impact.

4.4.1 Closure of Existing Site

Wildlife

The site is located within a boundary of a major industrial complex. Because of the current site development, there is no wildlife utilizing at the site. Wildlife is not expected to use the site as habitat for grazing after closure of the existing site.

Transportation

There is no transportation component in the site closure plan.

Property Value and Land Use

The existing site is located on land already zoned as heavy industrial. There is no use planned for the closed site. Because the site is located on Stone property, public use of the site is not anticipated. Land values will not be impacted by the closure.

4.4.2 New Ash Disposal Site

Human Health and Safety

Human health and safety is not a major consideration for this project. During construction, established construction practices and procedures will be followed to insure human safety.

There is a potential that exposure to the biomass ash may induce health problems such as respiratory ailments in workers. However, since contact with the ash will be limited and of a very short duration, it is predicted that there will be no impact to human health.

Commercial Recreational Uses

The current site because of its location has no commercial or recreational uses and is not expected to have when the site is closed.

4.5 MITIGATIVE MEASURES

A number of mitigative measures will be initiated to minimize the adverse impacts of this project while maximizing project benefits. The development strategy proposed by Stone incorporates an environmentally responsible approach to the closure of the existing disposal site as well as the development and operation of the new ash disposal facility.

A number of mitigative measures presently proposed have been outlined in Sections 4.2 and 4.3. These mitigative measures have been directed primarily at reduction of siltation runoff to the

river and blowing dust to the adjacent residents during construction. A summary of the measures to be employed during construction includes

- The sedimentation pond will be operational before any other site development is initiated
- All runoff from erodible areas to be directed to the sedimentation pond
- All reasonable measures shall be taken to control dust by employing such measures as spraying roads with water, and scheduling activities that potentially generate large quantities of dust during low wind speed periods.

The sedimentation pond will be designed holding capacity to provide a minimum 24 hour retention time for a 1:25 year 6 hour rainfall event.

Mitigative measures proposed during the operation of the new ash disposal facility include the regular placement of granular cover to prevent dusting, minimizing use of the site during periods of adverse weather, and wetting down the ash as required. The tree buffer will also act as a dust control mechanism. The new facility will be operated in accordance with established procedures designed to minimize any negative impacts.

4.6 ACCIDENTAL EVENTS

The previous sections have described the potential impacts on the Valued Environmental Components from predictable events involved with the construction operation and closure of the new site as well as closure of the existing site. However there is a remote possibility that one or more of the engineered systems could fail thus impacting the environment.

4.6.1 Closure of the Existing Site

The principal concern is the failure of the engineered soil cover thus increasing infiltration hence leachate generation. The increased leachate generation with heavier concentration of metals could impact on the groundwater quality surface water quality and aquatic life. These impacts were

discussed in Section 4.2.

Any major change in the groundwater chemistry would be detected in the monitoring wells. Depending on what the groundwater chemistry indicates, mitigative measures will be implemented. The type and extent of mitigative measures will be dependent on the particular situation and may include:

i) pump and treatment of the groundwater

ii) interception ditches perpendicular to the groundwater flow path

iii) construction impermeable barriers around contaminated area

The appropriate mitigative measures will be implemented by Sone based on the specific requirements.

Any breach in the soil cover will eventually become evident on the surface of the pile. Once detected this breach will be immediately repaired. Thus the impact of any breach of the soil cover is predicted to be minor.

4.6.2 New Disposal Site

The key elements of concern with the new ash disposal site is the engineered liner, leachate collection, and sedimentation pond. A failure of any of these systems, particularly in combination, may have negative results.

The most dramatic accident would be the failure of the sedimentation pond, releasing collected runoff directly to the Nepisiguit River. The likelihood of a failure of the sedimentation pond is considered remote. The failure would still have a major impact on the surface water quality in the short term and on aquatic life. However the flow rate of the Nepisiguit River, which ranges from 15.3 to 500+ m^3/sec (IEC Beak, 1985), will significantly reduce the long term effects of this failure.

The worst case scenario is assumed to occur if the entire volume of the sedimentation pond (6000 m^3) would enter the Nepisiquit River over a period of one day during summer low flow

conditions. The dilution factor of the Nepisiquit River under this scenario is in excess of 200.

In the unlikely event that failure occurred Stone will make every effort to minimize the impact in the surrounding areas. This will include trenching and rerouting of water flowing to the sedimentation pond plus making the necessary repairs to the system.

Other potential accidents of the new disposal site would be the failure of the engineering liner or leachate collection system or both in combination. Engineering liners are not totally impervious but rather relatively impervious. The imperviousness of a liner is a direct reflection of the quality control during construction. It is possible that the liner may be constructed with localized zones of weakness which may eventually fail. The "worst case" situation would be for failure of the liner in conjunction with failure of the leachate collection system.

Failure of the leachate containment system may have a direct impact on the groundwater quality. However considering that the site is underlain by 8 to 10 m of silty clay and glacial till, having hydraulic conductivities of $1x10^{-7}$ cm/sec or less, the impact from a potential failure is predicted to be minor. Furthermore, the groundwater monitoring program will detect any change in water quality.

4.7 SUMMARY

The predicted impacts for each site activity and VEC are summarized in the "Environmental Screening Matrix" shown on Figure 4-1.

In summary the worst situation for the project in question is minor impact of sediment laden runoff which can be mitigated through proper engineering design. A number of impacts of this project are positive.

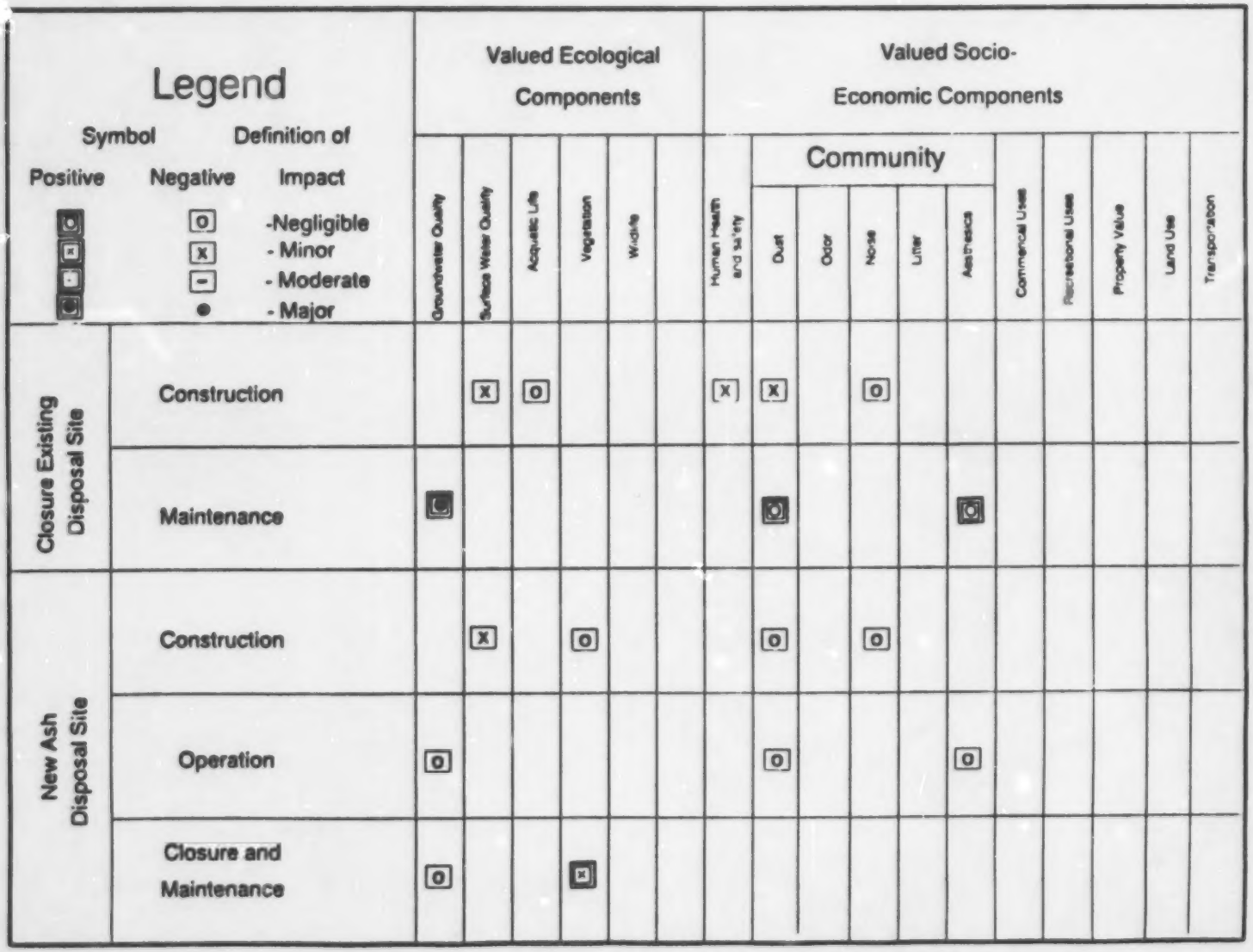


Figure 4.1
Environmental Screening Matrix

Note: There is no Predicted impact in areas not noted

5.0 MONITORING AND COMPENSATION

5.1 Proposed Monitoring Program

An acceptable long term monitoring program will be established to provide both compliance monitoring and environmental effects monitoring.

Compliance monitoring is normally undertaken by a proponent to ensure that regulated levels of parameters in discharges are met. Specific conditions will be described in the Approval to Construct and Operate which will be issued under the Clean Environment Act.

A complete Environmental Compliance Monitoring (ECM) program for this project will assure control of the ash disposal site and protection of the environment. The compliance monitoring during the development/construction, operation and closure of the new ash disposal site will be carried out to determine:

1. The quantity and quality of leachate in the holding pond. Leachate not meeting effluent regulations will require treatment.

2. The quality of surface runoff collected in the sedimentation pond prior to discharge.

3. Ambient particle levels.

The ECM will ensure that the project is in compliance with all provincial and federal government Acts and Regulations while ensuring that Stone's "Statement of Environmental Policy" (Appendix V) are maintained.

During construction, the ECM will be the responsibility of a site inspector retained by Stone who will ensure the contractor follows environmentally acceptable procedures. During operation and maintenance Stone will be responsible for compliance monitoring. The requirements for reporting the ECM monitoring program will be defined by NBDOE.

Stone currently have site personnel familiar with all aspects of the types of monitoring required. Compliance monitoring of the waste water discharge has been ongoing since 1986. A senior staff member of Stone will be assigned responsibility for this project. Stone personnel on site will be instructed to observe and correct any incidence leading to excessive emissions of dust into the environment.

The Environmental Effects Monitoring Program (EEM) proposed includes monitoring to ensure the effectiveness of constructive practices, the leachate containment and collection system, and the soil cover placed over the existing disposal site. The program, which will start prior to the construction phase and be continued until the site can be permanently abandoned, will be modified as dictated by the results of monitoring.

The monitoring of environmental effects will be carried out to determine:

1. Surface water quality and the state of the aquatic habitat and populations in areas within the study boundary

2. Groundwater quality in the vicinity of the site.

During construction and operation of the new disposal site, water samples will be recovered at the point of discharge of the sedimentation pond weekly and measured for suspended solids and turbidity. The discharge will meet NBDOE requirements for discharge as outlined in the ATC/O. During operation discharge will be monitored semi-annually. Monitoring frequency will be subject to modification by NBDOE.

The monitoring of groundwater at the new disposal site will require a number of monitoring wells strategically placed around the disposal site both downgradient and upgradient. Stone will install a single line of monitoring wells along the eastern boundary of the of the new site to detect any potential contaminant plume. The exact spacing and depth of monitoring wells will be determined based on the results of additional hydrogeologic analysis. The final spacing will meet the requirements of the ATC/O. Stone will also install several monitoring wells upgradient along

the western boundary of the site.

For the existing disposal site, the monitoring program will involve the three monitoring wells recently installed by Nolan, Davis plus several wells along the western boundary installed during previous investigations.

The monitoring well design will be based on site-specific geological conditions and types of contaminants monitored. The wells will be cased to maintain borehole integrity with the casing screened and packed with gravel or sand where necessary to enable sample collection. The annular space between the borehole wall and well casing above the sample point will be sealed with an appropriate material, such as cement grout or bentonite.

The groundwater from the monitoring wells will be tested for a full suite of parameters annually, but total suspended solids, BOD, total dissolved solids, total organic carbon, and pH will be measured quarterly. Monitoring will continue during operation and into the site closure period in accordance with requirements established by NBDOE. Should analytical results indicate drastic increases in parameters, the sampling frequency will be increased in order to monitor these changes. Should any of the indicator parameters display a change of more than 15 percent relative to its local background concentration, a full chemical analysis will be carried out. On an annual basis the full suite of parameters to be monitored consists of pH, aluminum, ammonia, arsenic, barium, boron, calcium, chloride, copper, iron, magnesium, manganese, mercury, nitrate, nitrite, potassium, sodium, vanadium, conductivity, total dissolved solids, and total organic carbon.

As part of the groundwater monitoring program Stone will also recover water samples from each of the seven drinking wells in South Bathurst for analytical testing. The chemical testing of these samples will be carried out before any site activity.

In 1985, Stone retained IEC Beak Consultants to carry out a complete baseline assessment of the benthic components as well as the water quality of the Nepisiguit River environment. This study will be updated in 1992 prior to the construction of the new facility and every two years thereafter. The periodic monitoring of the aquatic ecosystem will provide an indication of any

alteration to the environment due to the project.

Following site closure, monitoring will continue on an annual basis for groundwater quality. There will also be a periodic inspection program of both sites.

5.2 COMPENSATION

The EIA has not identified any requirements for compensation. Stone however will develop contingency plans in the unlikely event of an accident or system failure. Contingency plans will be submitted with the application for Approval to Operate/Construct permit.

6.0 PUBLIC CONSULTATION

Public consultation is a vital element in the process which is mandated under the Environment Impact Assessment Regulation. The Guidelines for this project require that Stone consult with persons and organizations potentially affected by the project and to incorporate their concerns in the Study.

As the initial step in the public consultation process, a Consultative Committee was formed with whom the progress and options being considered was reviewed throughout the EIA process. The Committee, which was comprised of representatives from a number of Bathurst area groups and organizations potentially impacted by the project, is considered to be a representative cross section of the public impacted by the project. A listing of the people who served on this Committee is presented in Table 6-1. A total of three meetings was held with the Consultative Committee Minutes from each of these meetings are provided in Appendix II. The input of the Committee was invaluable in assessing the public concerns regarding this project.

An open house information session was held for the public on the evenings of May 15, and 16, 1991 at the Atlantic Host Inn in Bathurst. The open house was advertised on radio and in the local newspaper. The project was displayed for the public to review and comment. Approximately twenty people attended the open house. Through this open house, public opinions were solicited and concerns identified.

At the request of residents of South Bathurst, another open house was put on in the basement of St. Theresa Church in South Bathurst on May 23, 1991. Seven people who are residents of the area attended this session.

Table 6-1

EIA Consultative Committee
Stone-Consolidated Inc.
Ash Disposal Facility

Name	Association
Bob Baker	Nepisiguit Salmon Association
Louis Arseneau	Nepisiguit Trout Protection Association
Graham Wiseman	Union, I.U.O.E., Local 894
Ken Frenette	South Bathurst Citizen
Harvey Boucher	East Bathurst Citizen
Gerry Doucet	City Council
Rheal Boudreau	Solid Waste Commission
Donna Hicks	Ecochaleur
Helen Thibodeau	Ecochaleur
Rick Schwenger	Nepisiquit Salmon Association
Ben Paul, Sr.	Pabineau Indian Band
Ron Gauthier	Nepisiguit Nature Club
Edgar Frenette	Stone-Consolidated Inc.
Reg Miller	Stone-Consolidated Inc.
Roland Garvie	Stone-Consolidated Inc.
Jocelyn Larocque	Stone-Consolidated Inc.
Pat Mersereau	Stone-Consolidated Inc.
Michael Riley	Nolan Davis and Associations (N.B.) Ltd.
Marc Caissie	Roy Consultants

7.0 CONCLUSIONS

Overall the project as presently proposed will be a great improvement over the current situation. The closure of the existing disposal site will stabilize the existing slopes, eliminate existing problems with dusting, and provide increased protection for groundwater quality. The new ash disposal site will be developed in an area which has ideal hydrogeologic characteristics for this type of development. The disposal site will be operated in an environmentally acceptable manner to mitigate community concerns. The new site will be designated for the disposal of a waste which is a byproduct from the combustion of wood waste. There will therefore be none of the adverse impacts normally encountered with MSW landfills such as litter, odour, birds and rodents.

The EIA Study has determined that the impacts to the biophysical and socioeconomic setting of both the closure of the existing disposal site and development of the new disposal site are limited to several issues, each predicted to be minor. Overall, the engineering design and site location have minimized or avoided potential impacts. Impact predictions are summarized by project activity for both the biophysical impacts and socioeconomic setting in Figure 4-1. Several of the activities of this project are predicted to have a positive impact on the environment. Foremost is the positive effect the closure has on the community issues of dust control and aesthetics.

With the application of a comprehensive mitigation program, particularly during construction, most of the predicted impacts can be reduced to levels of negligible or no impact. Generally, standard construction practices will mitigate potential environmental concerns associated with construction. Notwithstanding mitigation, the "worst case" situation whereby one or more systems fail due to accidental events of very low likelihood, is predicted to have only a minor impact. All socioeconomic impacts have been reduced to negligible or no impact.

To further characterize and potentially reduce predicted impacts, Stone has proposed a Monitoring Program which is comprised of both Environmental Compliance Monitoring and Environmental Effects Monitoring studies. The compliance monitoring program outlines how Stone intends to ensure it complies with regulatory requirements while environmental effects will monitor groundwater quality, surface water quality and aquatic resources.

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APPENDIX I

GUIDELINES FOR AN ENVIRONMENTAL IMPACT ASSESSMENT

STONE CONSOLIDATED INC. ASH DISPOSAL FACILITY

Issued by the Minister of the Environment
for the Province of New Brunswick

to

STONE CONSOLIDATED INC.

March 13, 1991

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1.0 INTRODUCTION

1.1 Purpose

These guidelines are to be used in the process of an Environmental Impact Assessment (EIA) of the proposal by Stone-Consolidated Inc. of Bathurst, N.B. to:

1. Construct and operate a disposal facility for boiler ash.

2. Abandon and rehabilitate an existing ash disposal facility located within the City of Bathurst.

Boiler ash is the waste product produced from the combustion of "hog fuel" at the Stone -Consolidated Inc. mill located in Bathurst. Hog fuel is comprised of wood debris and bark.

These guidelines identify the important issues arising from the proposal which should be addressed in the EIA.

The Minister of the Environment, for purpose of assessing the environmental impacts of this undertaking, may require Stone-Consolidated Inc. to examine issues beyond the scope of existing regulations, if he deems this necessary to ensure environmental protection.

The development of the proposed site and the closure of the existing site will be jointly referred to as the proposal, undertaking or project in these guidelines.

1.2 Environmental Impact Assessment Process

Under Regulation 87-83 of the Clean Environment Act, Stone-Consolidated Inc., as the proponent of the project, was required to register the proposed Ash Disposal Facility and the closure of the existing facility as undertakings for Environmental Impact Assessment (EIA) screening. The proposal was registered on June 19, 1990. On November 13, 1990, the Minister of the Environment determined that the completion of an EIA was required to assess the nature and significance of the proposal's potential impacts.

The Minister of Environment has appointed a Review Committee comprised of technical specialists from various government agencies whose jurisdictions may be affected by the undertaking. These agencies include:

The N.B. Department of the Environment
The N.B. Department of Natural Resources and Energy
City of Bathurst
The N.B. Department of Health and Community Services
Environment Canada

The Review Committee developed draft guidelines for the EIA study which were released for public review on January 13, 1991. The guidelines identify the important issues which must be considered in assessing the impacts of the proposed development. They also specify the approach the proponent should follow in conducting the EIA.

These final guidelines, issued on March 13, 1991 incorporate the comments and concerns received by the Minister during the public review of the draft guidelines.

On receipt of the final guidelines, Stone-Consolidated Inc. and/or its consultant is required to provide the Minister with detailed Terms of Reference which describe the approach to be used in the EIA study. Approval of terms of reference by the Department must be obtained through a consultative process involving the proponent, the proponent's consultant, and the appropriate government review agencies.

Following approval of the Terms of Reference for the EIA, the proponent conducts the EIA. The principle objective of the study is to predict the impacts which can be expected should the project proceed. The study, conducted in consultation with the residents from the area of potential impact, is also expected to identify methods of enhancing positive impacts and minimizing negative impacts resulting from the undertaking.

Information gathered during the study is compiled in a draft EIA report. The report is then reviewed by the Review Committee to determine whether the report adequately addresses the issues raised in the study guidelines. Should the Review Committee determine the report does not adequately address the guidelines, the proponent is expected to make revisions to address identified deficiencies in order to advance the EIA process.

If, on the advice of the Review Committee, the Minister is satisfied that the EIA report is adequate, the next step is to involve the public in discussing the impacts which the final report describes.

A summary of the final report is prepared on behalf of the Minister to assist members of the public in becoming familiar with the information. The Review Committee also prepares a General Review Statement summarizing its comments on the EIA study document. These documents are released for a period of at least 30 days for public review and comment. At this time, the schedule and location(s) of public meeting(s) are announced by the Minister.

Public meetings generally take place near the area where the project is being proposed and provide all interested parties with an opportunity to make comments, raise concerns or ask questions about any matter covered in the EIA study. Following the public meeting, an additional period of fifteen days is set aside for members of the public to submit further written comments to the Minister.

At the end of this period, a summary of public participation is prepared, distributed to the public and presented to the Minister.

At any time after this date, the provincial government (Lieutenant-Governor in Council) may make a decision to issue or deny an approval for the project.

Specific procedures to be followed in conducting an EIA may be found in Regulation 87-83, Environmental Impact Assessment Regulation - Clean Environment Act. A procedural summary is available in the publication entitled "Environmental Impact Assessment in New Brunswick". These documents may be obtained from

The Department of the Environment
P.O. Box 6000
364 Argyle St.
Fredericton, N.B., E3B 5H1

2.0 METHODOLOGICAL APPROACH TO EIA

2.1 General

The Environmental Impact Assessment process results in a detailed study of potential environmental impacts and the methods which may be used to control those effects.

To provide a focus for the EIA, ecosystem components which are potentially at risk and which are considered of significant value must be identified in the study. This value is based not only upon scientific or economic judgements, but also upon subjective social values and public perceptions.

These guidelines highlight, in Section 4.0, a number of specific issues to be addressed. However, the study should not be limited by this framework. Should additional issues arise out of discussion with members of the review committee, regulatory agencies or members of the public, the proponent is encouraged to incorporate these into the analysis of the project's impact.

2.2 Study Boundaries

The proponent must clearly define the boundaries of the study in time and space.

The temporal scope of the study (the length of time considered) must reflect the construction period, the life expectancy of the project, and any potential residual impacts which may remain beyond the operating period and site rehabilitation.

The proponent must clearly define and justify the spatial boundaries of the study (the distance from the site) based on the potential for significant impact. Spatial boundaries for the proposed project must incorporate areas affected by transportation of materials to the site as well as those affected by noise, airborne particulate matter, odours, visual impacts, and movement of leachate and/or solids into water resources.

2.3 Prediction of Environmental Effects

The main focus of the environmental impact assessment must be to predict changes to the environment which may result from the undertaking. Predictions must consider all aspects and phases of the project, and any secondary, cumulative or synergistic effects.

EIA predictions are generally based on a combination of objective and subjective evaluation. The use of objective (measurable) analysis is strongly preferred. However, in recognition of the factors which limit the ability to predict environmental responses, it is expected under certain circumstances that predictions may be based in part on subjective evaluation using professional judgement, speculation or experience. In consideration of this, predictive statements should be accompanied by a discussion of the limitations of the analysis, as well as references to supporting documentation.

Predictions must be made regarding the nature, magnitude, duration and distribution of the project's environmental effects. These predictions must:

1. Facilitate decision-making with respect to the proposed project.
2. Clearly specify the degree of uncertainty inherent in the projections.
3. Clearly identify impacts with respect to tolerance levels of organisms in the environment.
4. Be amenable to testing through ongoing monitoring.

The EIA must also evaluate the significance of predicted impacts. In order to do this, objective criteria for determining if these impacts are significant should be established through consultation with the technical review committee prior to the conduct of the studies.

The significance of project-induced changes on valued environmental components should be stated in the EIA Report in the most unambiguous manner possible.

2.4 Commitment to Monitoring

A well defined program of monitoring the effects of the project must be outlined in the EIA. This program must provide information:

1. To test the predictions of the EIA study.

2. To evaluate the effectiveness of the measures used to prevent or minimize environmental impacts.

The monitoring program must be based upon accurate baseline information of the existing environment (physical, biological, socioeconomic). The proponent is expected to collect the necessary information through existing data sources or through primary research (field work, laboratory testing).

Where the EIA predictions are not based on objective information, the monitoring program must be designed, where possible, to collect any data not previously available.

2.5 Prevention, Mitigation and Compensation

The study must describe alternative methods of preventing or mitigating (minimizing) damage to the environment.

Specific circumstances under which mitigation measures will be implemented must be clearly defined by the proponent.

Contingency plans must be generated:

1. For use in the event of an environmental emergency attributable to the project, within the spatial boundaries of the study.

2. For use in the event of significant impacts, attributable to the project, which are detected through monitoring. This plan must be designed to be implemented should impacts be detected during construction, operation, rehabilitation, or following abandonment of the facility.

The study must outline a plan for a compensation mechanism to be used in the event that environmental damage occurs. This plan must be developed through consultation with federal and provincial agencies and other stakeholders.

2.6 Public Consultation

Stone-Consolidated Inc. should conduct ongoing consultation with persons and organizations potentially affected by the construction and operation of the facility, and should continue to incoporate their concerns into the study. The objectives of this consultation should be:

1. To ensure that affected publics are well informed, prior to the government's approval decision, as to nature and extent of environmental costs as well as the benefits attributable to the proposed project.

2. To ensure that the values and concerns of the public are incorporated and adequately addressed in the study.

2.7 Terms of Reference

The proponent is required to submit detailed terms of reference in response to the EIA guidelines. These should describe the methods proposed for carrying out the EIA, and the means by which Stone Consolidated-Inc. will consult with the public during the course of the EIA study.

The proponent is required to provide, as part of the terms of reference, a form of index or concordance document which indicates all of the headings and issues which are part of the final guidelines and where these items have been addressed within the terms of reference document.

The terms of reference will be examined by the Review Committee, and comments may be provided to the proponent.

3.0 CONDUCT OF THE STUDY AND CONTENT OF REPORT

3.1 Description of the Existing Environment

Section 31.1(1) of the Clean Environment Act, defines "environment" as:

(a) air, water, or soil

(b) plant and animal life including human life, and

(c) the social, economic, cultural and aesthetic conditions that influence the life of humans or a community as they are related to the matters described in (a) and (b).

The EIA Report should describe the existing environment within the study boundaries to provide the reader with a basic understanding of the potential interactions with the proposed project.

A description of each site must include a description of the terrain, an analysis of soil characteristics and a discussion of the underlying geology.

The study must include an inventory of potentially affected biological resources which are determined to be valued ecosystem components (ie wildlife and habitat).

The study must clearly document the presence of any unique, infrequently encountered, vulnerable, rare, or endangered species, occurrences or habitat that may be affected by construction or operational activities.

The current status and uses of potentially affected watercourses and groundwater resources, including springs, must be described.

Current land use (recreational, agricultural, residential, industrial) within the spatial boundaries of the study must be documented. Population densities adjacent to the sites must be recorded.

Current usage and condition of roads leading to the facility must be described.

3.2 Project Description

The EIA report must clearly describe, in detail, all aspects of the project from the planning phase through construction, operation, abandonment and site rehabilitation.

The location, size, capacity, boundaries, physical facilities (including roads, security systems, leachate collection and treatment systems) and layout for the proposed facility must be described.

The amount, origin and components of the waste must be predicted. Information concerning the amounts and components of wastes in the existing facility must be obtained.

The amounts and characteristics of all effluents, both liquid and gaseous must be predicted for both the proposed and the exisiting site.

For the existing site, all flow paths for the liquid effluent (eg. overland flow and groundwater leachate plume) must be located and identified.

Describe the transportation routes to the site(s) with expected volumes of traffic if transportation occurs on a municipal or provincial street, road or highway.

3.3 Project Rationale

The report must provide clear justification for the project in order to allow for an evaluation of the relative costs and benefits of the proposed development.

3.4 Identification and Analysis of Alternatives

The study should evaluate alternatives to the project as proposed. This analysis will contribute to a further understanding of the project rationale and will facilitate decision-making with respect to its acceptability.

The project as proposed should be compared to the following alternatives with reference to potential for environmental impact:

(a) The null alternative. The study must examine the implications of not proceeding with the project with reference to economic, environmental and social factors.

(b) Alternative locations. A description of the methodology used to select a site and the results of the site selection process should be presented. Where existing government guidelines have been used in the siting process, those guidelines should be referenced. Discuss the costs associated with each of the alternative locations.

(c) Alternative technologies for ash disposal/use.

(d) Alternative methods for prevention or mitigation of environmental impacts. These alternatives should be compared on the basis of effectiveness for environmental protection for the entire study area and for the entire lifespan of the project, including abandonment. Discuss the costs of each of the alternatives.

4.0 SIGNIFICANT ISSUES

4.1 Socioeconomic Impacts

If the proponent intends to proceed with this development in an area which has been relatively undisturbed, the EIA Report should consider the effects that the project may have on traditional resource uses such as angling, hunting ,trapping, camping, tourism, etc.

Predict the impacts of the proposal on the community with respect to aesthetics, odour, litter, noise and abuse of access roads.

The impact of the proposed landfill on property values should be evaluated within the limits of the determined project boundaries.

The effect on present and future land use patterns and infrastructure requirements should be predicted with a focus on residential and agricultural uses. Impacts on amenities should be evaluated.

4.2 Impacts on Groundwater

The impact of the proposed landfill on groundwater (including springs) for domestic, agricultural, industrial, and municipal uses should be assessed. Consideration should be given to existing and potential groundwater use. In approaching this subject it should be assumed that there is potential for failure of a containment system, resulting in migration of leachate out of the landfill.

An evaluation of the potential for interaction between the groundwater and surface water systems should be included in this section.

4.3 Impacts on Surface Water

The impact of the proposed landfill on surface water resources should be assessed. The analysis should focus on surface water as it relates to the maintenance of existing water quality, fish populations and compatibility with existing and potential uses for recreation and agriculture (eg. crops and livestock).

4.4 Human Health Impacts

The effect of a landfill in the proposed location on human health and safety related to drinking water, airborne particulate matter, and gases potentially released from the landfill, traffic and fire should be evaluated.

4.5 Transportation Impacts

Predict the impacts of traffic to and from the site with reference to noise, safety, risks of spills, and property values.

4.6 Impacts on Plants and Animals

Predict the impacts of construction and operation of the landfill on plants and animals and their habitat. Include impacts to local deer populations, populations of rare or endangered plant and animal species as well as other plant and animal populations.

APPENDIX II

TECHNITROL·ECO
RECHERCHES • RESEARCH

121 Boul. Hymus, Pointe Claire, Québec H9R 1E6 Tél.: (514) 697-3273 Fax: (514) 697-2090

STONE CONSOLIDATED INC.
Division Bathurst
Mr. Michael Aubie
891, Main Street
BATHURST (New Brunswick)
E2A 4A3

DATE: June 19, 1990

PROJECT: 903123
P.O.: 17909909
CLIENT: 2371

RÉSULTATS • RESULTS

RE: RESULTS OF ANALYSIS ON TWO FLY ASH SAMPLES RECEIVED MAY 3, 1990.

PARAMETERS	UNITS	MÉTHODS	DETECTION LIMITS	001	002
Total Carbon	%	Leco furnace	0,01	4,56	15,98
pH	---	Électrode	1,0	13,2	12,9
Chloride	(mg/kg)	Titration with $Hg(NO_3)_2$	10	1 006	774
Sulphate	(mg/kg)	Turbidimetry	100	3 120	16 600
Arsenic	(mg/kg)	Hydride generation	0,2	4,3	4,2
Boron	(mg/kg)	ICP	2,0	248	170
Cadmium	(mg/kg)	Atomic absorption	2,0	3	3
Chromium	(mg/kg)	ICP	2,0	57	54
Copper	(mg/kg)	ICP	6	141	143
Iron	(mg/kg)	ICP	1	16 120	15 120
Magnesium	(mg/kg)	ICP	1	11 745	12 232
Mercury	(mg/kg)	Cold vapor	0,02	0,4	0,7
Nickel	(mg/kg)	ICP	10	< 10	117
Lead	(mg/kg)	Atomic absorption	10	29	31
Selenium	(mg/kg)	Hydride	0,2	0,34	0,64
Titanium	(mg/kg)	ICP	10	974	834
Vanadium	(mg/kg)	ICP	10	38	91
Zinc	(mg/kg)	ICP	6	472	529

Micheline Godin

MG/sd

Micheline Godin, Chemist

CE RAPPORT EST POUR L'USAGE EXCLUSIF DU CLIENT ET NE PEUT ÊTRE REPRODUIT SANS UNE PERMISSION ÉCRITE DE TECHNITROL • ECO INC. LES ÉCHANTILLONS MENTIONNÉS PLUS HAUT SERONT CONSERVÉS PENDANT 30 JOURS À PARTIR DE LA DATE DU RAPPORT À MOINS D'INSTRUCTIONS ÉCRITES DU CLIENT

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Clayton Environmental Consultants, Ltd.

949 McDougall • Windsor, Ontario N9A 1L9 • (519) 255-9797 • Fax (519) 255-9304

May 22, 1990

Mr. Michael F. Aubie
STONE CONSOLIDATED INC.
891 Main Street
Bathurst, New Brunswick
E2A 4A3

Clayton Project No. 29156.00
Client P.O. No. 17909910

Dear Mr. Aubie:

Attached is our analytical laboratory report for the samples received on May 4, 1990.

Please note that any unused portion of the samples will be disposed of after approximately 30 days, unless you have requested otherwise.

We appreciate the opportunity to be of assistance to you. If you have any questions, please call us at (519) 255-9797.

Sincerely,

Paul S. Epstein, Ph. D.
Manager, Laboratory Services
Canadian Operations

PSE/po
Attachment

Table 1 Page 1

Results of Crystalline a-Quartz Analysis

for

STONE CONSOLIDATED INC.

Clayton Project No.: 29156.00-1
Sample Matrix/Media:Bulk — Date Received: 05/04/90
Analytical Method:X-ray Diffraction — Date Analyzed: 05/16/90

Lab Number	Sample Identification	Crystalline a-Quartz (%)
C45302	001	14
C45303	002	9
	Limit of Detection:	1

No cristobalite was found in the samples. Cristobalite LOD = 2%

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STONE-CONSOLIDATED
Div. Bathurst
A/S Mr. David Maloney
891 Main Street
BATHURST (New Brunswick)
E2A 4A3

April 9, 1991
PROJECT: 911530
CUST.: 2371

Résultats • Results

RESULTS OF ANALYSIS ON THE ASH SAMPLE RECEIVED FEBRUARY 26, 1991

ANALYSIS	RESULTS
Loss on ignition - 550°C (%)	3.1
Loss on ignition - 800°C (%)	8.3
Silicate as SiO_2 (%)	48.73
Sulphate (%)	0.78
Chloride (%)	0.08
Molybdenum (%)	< 0.001
Maganese (%)	0.55
Sodium (%)	0.23
Potassium (%)	1.7
Calcium (%)	5.8
Total carbon (%)	7.33
pH	12.9

MG/rv

Micheline Godin
Chemist

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ecotechnics • research

121 Haut Mousseau Pointe-Claire (Quebec) H9R 5E5
Tel.: (514) 697-0533 Fax: (514) 697-0534

STONE-CONSOLIDATED
Div. Bathurst
A/S Mr. David Maloney
891 Main Street
BATHURST (New Brunswick)
E2A 4A3

April 9, 1991
PROJECT: 911530
CUST.: 2371

Résultats • Results

RESULTS OF ANALYSIS ON THE ASH SAMPLE RECEIVED FEBRUARY 26, 1991

ANALYSIS	RESULTS	
Arsenic	0.92	ppm (mg/kg)
Boron	60.1	ppm (mg/kg)
Cadmium	9	ppm (mg/kg)
Chromium	19	ppm (mg/kg)
Copper	28	ppm (mg/kg)
Iron (%)	1.34	
Magnesium (%)	0.70	
Mercury	0.05	ppm (mg/kg)
Nickel	59	ppm (mg/kg)
Lead	35	ppm (mg/kg)
Selenium	0.26	ppm (mg/kg)
Titanium	510	ppm (mg/kg)
Vanadium	116	ppm (mg/kg)
Zinc	399	ppm (mg/kg)

MG/rv

Micheline Godin
Chemist

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5550 McADAM ROAD, MISSISSAUGA, ONTARIO L4Z 1P1
PHONE: 890-2555 • TELEX: 06-960496 • FAX: (416) 890-0370

WHATMAN 934 AH - 15... - Smalt...

STONE-CONSOLIDATED INC.
891 Main Street
Bathurst, New Brunswick
E2A 4A3

ENV-009

ATTN: Mr. Michael Aubie

REPORT #: 901946 CUSTOMER REF.#

DATE SUBMITTED: 90-05-03 DATE REPORTED: 90-06-25

---------- CERTIFICATE OF ANALYSIS ----------

Sample Description: FLYASH

Analysis Performed: POLYNUCLEAR AROMATIC HYDROCARBONS

The analytical protocol used was based upon U.S. EPA Method #3540, and #8270.
Samples were fortified with isotopically labelled internal standards, solvent extracted at neutral pH. The concentrated extracts were analyzed by capillary column gas chromatography/mass spectrometry (HRGC/MS) using Selected Ion Monitoring (SIM).

Note: Additional information is available on request.

Instrumentation:

- Hewlett Packard 5890 GC
- Hewlett Packard 5970 Mass Selective Detector
- DB-5, 0.25 mm I.D., 30 m column

Chemical Results: See Tables

Comments:

WITNESSED BY:
Richard Szawiola, B.Sc., C.Chem.*
Manager, Trace Organics

* Refer inquiries to

Members: Association of Official Racing Chemists, American Chemical Society, Canadian Society of Forensic Science, Chemical Institute of Canada, American Society for Testing and Materials, Canadian Federation of Independent Business, Better Business Bureau, Association of the Chemical Profession of Ontario, Association of Professional Engineers of the Province of Ontario, Canadian Association of Fire Chiefs, American Industrial Hygiene Association, Air Pollution Control Association, Canadian Society of Safety Engineering, International Society for Respiratory Protection

1946DIOX

MTL W.O. #901946

CONCENTRATION OF DIOXINS AND FURANS
CONC UNITS = ppb
MDL UNITS = ppb

COMPOUND CUMULATIVE ISOMERS	BLANK CONC	BLANK MDL	CONC	MDL
TETRA-CDD	--	0.016	--	0.010
TETRA-CDF	--	0.016	--	0.010
PENTA-CDD	--	0.016	--	0.050
PENTA-CDF	--	0.016	--	0.25
HEXA-CDD	--	0.220	--	0.015
HEXA-CDF	--	0.220	--	0.015
HEPTA-CDD	--	0.040	--	0.028
HEPTA-CDF	--	0.040	--	0.028
OCTA-CDD	--	0.040	--	0.028
OCTA-CDF	--	0.040	--	0.028
QA/QC DATA				
% REC C13-TCDD		68		45
% REC C13-OCDD		110		73

MDL = METHOD DETECTION LIMIT
- = NONE DETECTED
TR = TRACE AMOUNT DETECTED
CDD = CHLORINATED DIBENZODIOXIN
CDF = CHLORINATED DIBENZOFURAN

ANALYST: D Pond 06 June 90

PHONE 890-2555 • TELEX 06-960496 • FAX (416) 890-0370

Stone Consolidated Inc.
891 Main Street
Bathurst, New Brunswick
E2A 4A3

ENV-003

ATTN: Michael Aubie

REPORT #: 901946

CUSTOMER REF.# 17909908

DATE SUBMITTED: May 3/90

DATE REPORTED: June 6, 1990

CERTIFICATE OF ANALYSIS

Sample Description: ASH

Analysis Performed: POLYCHLORINATED DIBENZODIOXINS/FURANS

The analytical protocol used was based upon U.S. EPA Method #8280.
Samples were fortified with isotopically labelled internal standards, solvent extracted and the extracts subjected to a multi-component, chemically modified adsorbent clean up. The analysis was performed using selected ion monitoring gas chromatography/mass spectrometry (SIM-GC/MS).

Note: Additional information is available on request.

Instrumentation:

- Varian 3500 GC equipped with an on-column injection system equipped with a DB-5, 0.32 mm I.D., 30 m column.
- Finnigan 4500 MS-DS.

Chemical Results: See Tables

Comments:

Richard Szawiola, B.Sc., C.Chem.
Manager, Trace Organics

Members: Association of Official Analytical Chemists, American Chemical Society, Canadian Society of Forensic Science, Chemical Institute of Canada, American Society for Testing and Materials, Canadian Federation of Independent Business, Better Business Bureau, Association of the Chemical Profession of Ontario, Association of Professional Engineers of the Province of Ontario, Canadian Association of Fire Chiefs, American Industrial Hygiene Association, Air Pollution Control Association, Canadian Society of Safety Engineering, International Society for Respiratory Protection

PAH-TEM
1946-PAH

MTL W.O. # 901946

POLYNUCLEAR AROMATIC HYDROCARBONS

Conc. = ppm (ug/g)

PAH COMPOUNDS	MDL	FLYASH					
NAPHTHALENE	0.2	0.8					
ACENAPHTHYLENE	0.2	--					
ACENAPHTHENE	0.2	--					
9H FLUORENE	0.2	--					
PHENANTHRENE	0.2	--					
ANTHRACENE	0.2	--					
FLUORANTHENE	0.2	--					
PYRENE	0.2	--					
BENZO(a)ANTHRACENE	0.2	--					
CHRYSENE	0.2	--					
BENZO(b)FLUORANTHENE	0.2	--					
BENZO(k)FLUORANTHENE	0.2	--					
BENZO(a)PYRENE	0.2	--					
PERYLENE	0.5	--					
INDENO(123-cd)PYRENE	0.1	--					
DIBENZO(ah)ANTHRACENE	0.2	--					
BENZO(ghi)PERYLENE	0.2	--					
% RECOVERY							
D8 NAPHTHALENE		76					
D10 ANTHRACENE		37					
D12 BENZO(a)PYRENE		62					

TR = TRACE AMOUNT DETECTED
-- = NONE DETECTED
MDL = METHOD DETECTION LIMIT

ANALYST: J Klimpas , 90-06-25

APPENDIX III

NOLAN, DAVIS & ASSOCIATES LIMITED
CONSULTING ENGINEERS/GEOLOGISTS
403 Regent Street, Suite 6
Fredericton, New Brunswick E3B 3X7
Telephone (506) 458-9770
Fax (506) 450-2933

March 27, 1991

Minutes of EIA Consultative Committee
Stone-Consolidated Inc.
Ash Disposal Facility

Date: March 26/91
Place: Keddy's Bathurst Hotel & Convention Centre
Time: 7:30 p.m.

Attendance:

Bob Baker	Nepisiquit Salmon Assoc.
Louis Arseneau	Nepisiquit Trout Assoc.
Graham Wiseman	Union, I.U.C.E. Local 894
Harvey Boucher	East Bathurst Citizen
Gerry Doucet	City Council
Donna Hicks	Ecochaleur
Helen Thibodeau	Ecochaleur
Edgar Frenette	Stone-Consolidated Inc.
Roland Garvie	Stone-Consolidated Inc.
Jocelyn Larocque	Stone-Consolidated Inc.
Pat Mersereau	Stone-Consolidated Inc.
Reginald Miller	Stone-Consolidated Inc.
Florent Villeneuve	Stone-Consolidated Inc. - Montreal
Michael Riley	Nolan Davis & Associates
Marc Caissie	Roy Consultants

PURPOSE

Introduction meeting with Consultative Committee to explain project and define mandate of committee.

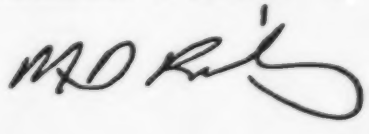
ITEM	ITEM DESCRIPTION	ACTION
1.1	R. Miller welcomed those in attendance and explained that Stone are asking for public assistance to address their concerns for the ash disposal project.	Record
1.2	M. Riley explained that the committee has been invited to represent the public concerns for the proposed project. The committee is considered an equal partner in the EIA process. Through the input of the committee, it is hoped that all the public concerns will be identified and considered in the final design.	Record

ITEM	ITEM DESCRIPTION	ACTION
1.3	M. Caissie outlined the proposed design for the new landfill. The project is designed to be a safe disposal site.	Record
1.4	D. Hicks asked for details on liner. M. Caissie indicated a clay soil will be used as a liner. The soil on site is suitable for use as liner and landfill capping. However additional material may have to be brought in the future.	Record
1.5	B. Baker questioned as to how long the liner will last. M. Caissie states that the life can be increased through a leachate collection. Other factors also impart.	M. Riley
1.6	The ash to be disposed is the by-product of burning wood. It is the only material which will be disposed. The ash leachate will increase the pH of water. Chemical test results of both ash and leachate will be provided next meeting.	M. Riley
1.7	B. Baker inquired if there was any backup for the leachate collection. L. Arseneau asked what is planned if piping breaks.	M. Caissie
1.8	R. Miller indicated that the landfill will extend to the Martha Aubie property behind Church Street.	Record
1.9	The ash will be placed in the landfill and covered as it is placed. Some ash will be exposed along the working face. No more than 1/3 of an acre will be open at one time. D. Hicks has a video on landfilling which she will bring to next meeting.	M. Riley
1.10	The retention time in the sedimentation pond is a minimum 24 hours.	Record
1.11	E. Frenette stated that the impacts from site construction will be addressed.	M. Riley
1.12	M. Riley stated that the project will also include closure of the existing ash pile.	Record
1.13	G. Wiseman indicated a big concern should be outward flow of water to the river. E. Frenette stated that a list of concerns will be available for next meeting.	M. Riley
1.14	The ash is transported to the site under the bridge by truck. Ash is wetted down and discharged as a muck or in powder form.	Record

ITEM	ITEM DESCRIPTION	ACTION
1.15	E. Frenette stated that water from site will flow away from the graveyard in South Bathurst.	Record
1.16	M. Riley explained the EIA process and how the study will be carried out. The Term of Reference for the study has been submitted to Environment.	Record
1.17	Closure of the old site will also be addressed. Additional details on water quality, composition of pile, leaching, etc., is required.	M. Riley
1.18	H. Boucher inquired about the flying wood dust. This problem is from the conveyor, not the chip pile. Preliminary studies have been started to find solution.	Record
1.19	The committee was requested to discuss project with citizens and bring back comments for next meeting. Committee also asked to participate in open house.	Record
1.20	M. Riley to draft up a Press Release for next meeting.	M. Riley

Next meeting, Tuesday, April 9, 1991 at Keddy's Hotel and Convention Center.

Distribution of minutes: M. Riley



Lalonde

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PROJECT:

EIA Consultative Committee
Stone-Consolidated Inc.
Ash Disposal Facility

LOCATION:

Keddy's Bathurst Hotel & Convention Centre

DATE:

April 9, 1991 7:30 p.m.

PRESENT:

Rheal Boudreau	**Solid Waste Commission**
Ken Frenette	**South Bathurst Citizen**
Ron Gauthier	**Nepisiquit Nature Club**
Graham Wiseman	**Union, I.U.O.E., Local 894**
Donna Hicks	**Eco-Chaleur**
Gerry Doucet	**City Council**
Helen Thibodeau	**Eco-Chaleur**
Louis Arseneau	**Nepisiquit Trout Assoc.**
Bob Baker	**Nepisiquit Salmon Assoc.**
Pat Mersereau	**Stone-Consolidated Inc.**
Reginald Miller	**Stone-Consolidated Inc.**
Edgar Frenette	**Stone-Consolidated Inc.**
Roland Garvie	**Stone-Consolidated Inc.**
Jocelyn Larocque	**Stone-Consolidated Inc.**
Mike Riley	**Nolan, Davis Associates**
Rod Currie	**R.A. Currie Ltd.**
Marc Caissie	**Roy Consultants**

APR 23 1991
ENGINEERING DEPT.

- **Please find copy of agenda attached.**

PURPOSE: Progress Meeting to discuss potential project impacts

ITEM		ACTION BY
	Review of Previous Minutes	
1.5	M. Cassie stated that based on testing carried out on soil samples at McGill, clay liner with a thickness of 1 metre will meet guidelines. The thickness of the liner is dependent on the quality of soil. Quality control of the liner will be required during construction. Testing of the placed soil 2 to 3 times per day required	Record
1.15	K. Frenette requested assurance that water will not flow south to the graveyard. One of the biggest concerns is the water on the streets in South Bathurst. E. Frenette stated that the site is north of the graveyard. Furthermore, runoff cells in the landfill (ash) will be collected and directed to the sedimentation pond	Record
New Business		
2.1	M. Riley, in response to questions by K. Frenette, stated that the ash disposal site proposed is the first in N.B. Most mills have a disposal site for more than one waste type	Record
2.2	E. Frenette stated that the leachate will be treated on site. If leachate is non-toxic and meets discharge requirements, it will be directed to the sedimentation point.	Record
2.3	The Press Release proposed was approved with minor changes. Names of committee members to appear in the release	R. Miller
2.4	Chemical testing was carried out at McGill on Stone ash. The results presented are the worst case namely under extreme conditions. E. Frenette stated that the leachate would not have the low pH unless acid rain. Typically the leachate has a high pH which will be lowered in the aeration tanks before discharge. J. Larocque stated that the flow of leachate will only be 20L/min maximum	Record

ITEM		ACTION BY
2.15	L. Arseneau asked if there was a mercury problem. A few years ago. Testing in the river indicated higher mercury levels near mill. E. Frenette stated that testing was done by Stone in 1983. M. Riley stated that mercury was not tested for in the testing carried out to date in the groundwater or surface water. E. Frenette stated that Stone could look at the mercury in the water	M. Riley
2.16	L. Arseneau stated that he feels we should know what is in the existing pile. M. Riley stated that the current excavation has opened up the pile and that on walking the site he noted wood, lime sludge, ash, and construction debris	M. Riley
2.17	M. Riley stated that as part of the closure plan, the government will require a monitoring program for groundwater. If any problems are detected, a response will be required	Record
2.18	M. Riley stated that we will ask around the mill for any information on wastes placed in the pile	J. Larocque
2.19	M. Riley outlined through the screening matrix site activities and possible impacts	Record
2.20	In response to L. Arseneau, M. Riley stated that the soil liner will be compacted in 8" layers using established procedures	Record
2.21	K. Frenette stated that dust has been a major problem for many years and that people are fed up. M. Riley outlined a number of procedures to control problem. The dust on roads and dust from trucks hauling ash is also recognized as a problem	M. Riley
2.22	L. Arseneau suggested Stone post a bond to insure landfill is closed	Record

ITEM		ACTION BY
2.5	M. Riley stated that he will have available information of soils with area which has a chemical composition similar to ash	M. Riley
2.6	Concerns were rere raised about other elements n the ash. In the past Stone has allowed other companies to dump chemicals from spills in the pile. The EIA to address these issues	M. Riley
2.7	H. Thibodeau asked whether people with wells will have problem	M. Riley
2.8	Additional testing of the existing site will be carried out with the results to be available for the next meeting	M. Riley
2.9	M. Riley stated that the new landfill site meets all NBDOE requirements for "landfill siting" except for the river being less than 300 m from site. The EIA will address this	M. Riley
2.10	M. Riley stated that the problems with the existing pile is that the slope is too steep and thus there is a risk of sliding into river. The site is presently being cutback to a stable slope and it is proposed to put a clay layer on top of the sloped pile to seal the site	Record
2.11	J. Larocque stated that the top of the existing ash pile is about 100 feet above sea level	Record
2.12	F. Frenette stated that Stone could not wait any longer to stabilize slope because of the high risk for failure	Record
2.13	M. Riley stated preliminary groundwater modelling below the existing pile indicates a localized groundwater condition. Additional studies required to determine rate of flow	M. Riley
2.14	R. Garvie stated that ash has been going to the site since 1986. Before 1986, lime sludge was deposited at the site. R. Miller stated that the waste is primarily sludge with wastes for the offices etc. going to the city dump.	

ITEM		ACTION BY
2.23	There are 2-3 trucks of ash/day on average. The ash is wetted down before it leaves the mill	Record
2.24	The collected leachate will have to meet the discharge requirements. There will be on going monitoring. The leachate will be put through the aeration tank of the existing waste water treatment plant to lower its pH	Record
2.25	Tentative date for Open House in May 15, 16 between 7 and 9 p.m. Committee members are asked for assistance.	Record
2.26	Next meeting May 8, 1991 7:30 p.m. Keddy's Motel, Bathurst, N.B.	

MO Riley

NOLAN, DAVIS & ASSOCIATES

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PROJECT:

EIA Consultative Committee
Stone-Consolidated Inc.
Ash Disposal Facility

LOCATION:

Atlantic Host Motor Inn

DATE:

May 9, 1991 **7:30 p.m.**

PRESENT:

Helen Thibodeau	**Eco-Chaleur**
Louis Arseneau	**Nepisiquit Trout Assoc.**
Pat Mersereau	**Stone-Consolidated Inc.**
Edgar Frenette	**Stone-Consolidated Inc.**
Roland Garvie	**Stone-Consolidated Inc.**
Jocelyn Larocque	**Stone-Consolidated Inc.**
Harvey Boucher	**East Bathurst Citizen**
Rick Schwenger	**Nepisiquit Salmon Assoc.**
Mike Riley	**Nolan, Davis Associates**

- **Please find copy of agenda attached.**

PURPOSE: **Final Progress Meeting to discuss the preliminary study results and "Open House"**

ITEM		ACTION BY
	Review of Previous Minutes	
2.8	M. Riley stated that three new boreholes have been put down through the existing ash pile. We have also walked over the excavated slope. Ash, bark, lime sludge and construction debris are the only materials noted of the material which has been moved to date (approximately 25% of the pile). Chemical testing on leachate samples collected from the boreholes show no mercury and no PCB's in the water.	Record
2.10	E. Frennette stated that Stone is pressuring the government for approval to put the cover on river side of existing disposal pile. Currently the pile has been sloped back from the river. The ash appearing on the ice this spring is a result of dusting during construction. The cover is required to control ash dusting. The old pile will be stabilized before the new landfill site begins operation.	Record
2.15	H. Boucher noted that tests were done in 1983 by the government which showed a high accumulation of chemicals such as mercury on the harbour bottom. L. Arseneau also stated that Noranda has test results from that period which vary greatly from the government tests. E. Frenette stated that there is no mercury in the water coming from the Stone site. The tests results from years past show higher concentration of mercury in the outer harbour than by mill. R. Garvie stated that slimicide is a bacteria which has not been used in paper process for at least 15 years.	Record
2.23	E. Frenette, in response to a question from H. Thibodeau stated that the ash will be transported entirely on Stone property. The ash trucks will not travel on King Street. A new wetting shower has been installed in the ash storage bin to help reduce the embers in the ash.	Record
New Business		Record
3.1	In response to a question by H. Boucher concerning the wood dust, E. Frennette stated that it will be addressed but not as part of the EIA. J. Laroque is working on this project.	Record

ITEM ACTION BY

3.2 M. Riley explained that the concerns expressed by Eco-Chaleur relating to the project description, alternatives, hydrogeology mitigation and monitoring will all be addressed in the EIA Report. Additional chemical testing has been carried out on both the "ash" leachate and recovered groundwater samples.

3.3 M. Riley stated that the computer modelling carried out as part of the EIA will be calibrated with existing site data. Record

3.4 The new landfill will require a certificate of authorization from the government before it can operate. The certificate will outline the monitoring program required. Should the conditions of operation not be adhered to, the enforcement branch of the government will act. Record

3.5 M. Riley presented the display by Nolan Davis of what the public will be seeing at the "Open House." The "Open House" will be held on May 15 and 16, 1991 between 7:00 and 9:00 p.m. It will include write-ups, pictures and sketches of the following:

1. Current operation
2. Stone-Consolidated Inc.'s environmental policy
3. Closing existing landfill
4. New landfill
5. Landfill operation
6. Dust control
7. Life of new landfill
8. Overall view of site, 1992
9. Community benefits
   a. existing site
   b. new site

M.D. Riley

APPENDIX IV

SURVEY OF VASCULAR PLANTS FOUND GROWING IN THE VICINITY OF THE PROPOSED BARK WASTE LANDFILL BATHURST, NEW BRUNSWICK JUNE 14, 1991

SUBMITTED SEPTEMBER 12, 1991
CONDUCTED BY HAROLD HINDS
ASSISTED BY GEORGE FLANDERS

EXPLANATION OF ABUNDANCE CLASSES

1. Rare at this site: only one or two populations observed.
2. Three or more populations observed: mostly scattered.
3. Uncommon at this site, but found occasionally throughout.
4. Observed consistently throughout, but coverage may not be large.
5. Commonly found throughout, often with considerable coverage.

FIELD AREA

Family/Species	Abundance
EQUISETACEAE	
Equisetum arvense	2
E. sylvaticum	2
OSMUNDACEAE	
Osmunda cinnamomea	2
O. claytoniana	2
POLYPODIACEAE	
Onoclea sensibilis	2
Pteridium aquilinum	2
PINACEAE	
Picea glauca	2
Pinus strobus	2
Thuja occidentalis	1
POACEAE	
Bromus inermis	4
Dactylis glomerata	1
Dichanthelium acuminatum var. implicatum	2
D. boreale	2
Festuca rubra	5
Phleum pratense	4
Poa pratensis	5
CYPERACEAE	
Carex crawfordii	4
C. echinata	2
C. debilis	2
C. gynandra	3
C. pallescens	2
C. stipata	2
Scirpus microcarpus	2
JUNCACEAE	
Juncus effusus	2
J. tenuis	2
Luzula multiflora	3
IRIDACEAE	
Sisyrinchium montanum	2

SALICACEAE	
Populus balsamifera	1
P. grandidentata	2
P. tremuloides	3
Salix petiolaris	2
S. discolor	2
BETULACEAE	
Alnus incana	2
Betula papyrifera	2
Corylus cornuta	2
POLYGONACEAE	
Rumex acetosella	3
CARYOPHYLLACEAE	
Silene vulgaris	2
Stellaria graminea	3
RANUNCULACEAE	
Ranunculus acris	2
R. repens	4
ROSACEAE	
Amelanchier humilis	1
A. laevis	1
A. wiegandii	3
Crataegus chrysocarpa	1
Fragaria virginiana	2
Geum aleppicum	1
Potentilla norvegica	1
P. recta	2
Prunus virginiana	2
Rubus pubescens	3
R. setosus	3
R. vermontanus	2
Sorbus decora	2
Spiraea latifolia	1
FABACEAE	
Lathyrus pratensis	2
Melilotus alba	2
Trifolium aureum	2
T. pratense	3
T. repens	3
Vicia cracca	3
OXALIDACEAE	
Oxalis stricta	2
ACERACEAE	
Acer pensylvanicum	2
A. rubrum	3
ONAGRACEAE	
Oenothera biennis	1
O. perennis	3

ARALIACEAE	
Aralia nudicaulis	3
APIACEAE	
Carum carvi	2
CORNACEAE	
Cornus canadensis	3
C. sericea	2
ERICACEAE	
Vaccinium angustifolium	3
V. myrtilloides	2
PRIMULACEAE	
Trientalis borealis	2
APOCYNACEAE	
Apocynum androsaemifolium	2
LAMIACEAE	
Prunella vulgaris	2
SCROPHULARIACEAE	
Veronica serpyllifolia	2
PLANTAGINACEAE	
Plantago major	3
RUBIACEAE	
Galium mollugo	3
CAPRIFOLIACEAE	
Diervilla lonicera	2
ASTERACEAE	
Achillea millefolium	3
Ambrosia trifida	1
Anaphalis margaritacea	2
Aster cordifolius	2
A. lanceolatus	1
A. macrophylla	3
A. puniceus	2
A. umbellatus	2
Cirsium arvense	2
Erigeron strigosus	2
Hieracium aurantiacum	2
H. pilosella	3
Leucanthemum vulgare	3
Solidago canadensis	3
S. graminea	3
S. rugosa	3
Sonchus arvensis	2
Taraxacum officinale	4

WOODS AREA

Family/Species	Abundance
LYCOPODIACEAE	
Lycopodium clavatum	1
L. complanatum	2
L. lucidulum	2
L. obscurum	2
L. tristachyum	1
POLYPODIACEAE	
Dryopteris intermedia	3
D. spinulosa	3
D. spinulosa X D. intermedia	1
Gymnocarpium dryopteris	2
Thelypteris noveboracensis	2
PINACEAE	
Abies balsamea	2
Picea rubens	2
Pinus banksiana	4
Thuja occidentalis	3
POACEAE	
Agropyron repens	2
Agrostis tenuis	4
Calamagrostis canadensis	3
Danthonia spicata	5
Glyceria striata	2
Oryzopsis asperifolia	1
Poa compressa	2
P. saltuensis	1
CYPERACEAE	
Carex aenea	2
C. arctata	4
C. brunnescens	3
C. communis	3
C. deflexa	3
C. deweyana	2
C. leptonervia	3
C. scabrata	2
C. tincta	1
C. trisperma	2
C. umbellata	3
JUNCACEAE	
Luzula acuminata	2
LILIACEAE	
Smilacina canadensis	4
S. racemosa	2
Streptopus amplexifolius	1
S. roseus	2
Trillium undulatum	3
ORCHIDACEAE	
Platanthera orbiculata	1

MYRICACEAE	
Comptonia peregrina	3
BETULACEAE	
Alnus incana	3
A. viridis	3
Betula alleghenienses	2
FAGACEAE	
Fagus grandifolia	2
RANUNCULACEAE	
Actaea rubra	2
ROSACEAE	
Amelanchier bartramiana	2
Malus pumila	1
Prunus pensylvanica	3
Sorbus decora	2
OXALIDACEAE	
Oxalis acetosella	3
AQUIFOLIACEAE	
Nemopanthus mucronata	3
ACERACEAE	
Acer spicatum	2
BALSAMINACEAE	
Impatiens capensis	2
VIOLACEAE	
Viola incognita	3
V. obliqua	2
V. selkirkii	1
V. septentrionalis	2
ONAGRACEAE	
Epilobium angustifolium	3
ARALIACEAE	
Aralia hispida	2
APIACEAE	
Hydrocotyle americana	1
PYROLACEAE	
Chimaphila umbellata	2
Moneses uniflora	1
Pyrola americana	2
P. elliptica	2
ERICACEAE	
Gaultheria procumbens	3
Kalmia angustifolia	4

OLEACEAE	
Fraxinus nigra	1
LAMIACEAE	
Lycopus uniflorus	1
SCROPHULARIACEAE	
Linaria vulgaris	2
Melampyrum lineare	2
RUBIACEAE	
Galium obtusum	2
G. trifidum	2
Mitchella repens	2
CAPRIFOLIACEAE	
Linnaea borealis	3
Sambucus racemosa	2
Viburnum cassinoides	3
V. lantana	2
ASTERACEAE	
Antennaria neglecta	2
Aster acuminatus	3
A. puniceus	2
Hieracium florentinum	2
Petasites frigidus	2
Prenanthes altissima	2
P. trifoliolata	3
Solidago hispida	2
S. juncea	2
S. macrophylla	1
S. puberula	2
S. squarrosa	1